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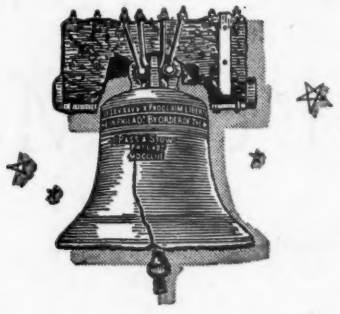

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or land or life, if freedom fail?"

...EMERSON

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CARE OF THE PATIENT BEFORE AND AFTER OPERATION*

With Special Reference to Fluid Requirements and the Importance of the Weighing Scale in Evaluating the Status of Hydration

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THE subject assigned to me has to do with the safe conduct of the patient through his operation. And if all the answers to all problems bearing on such an issue were available to the surgeon undertaking an elective operation, his course of action would unquestionably be altered in many circumstances. The items that assure safe conduct of a patient through the hazards of an operation might well be discussed under the following three headings: the preparation of the surgeon, the preparation of the dissection and the preparation of the patient and his care after operation.

The adjudication of the element of risk alone is an item of great importance not only to the surgeon but also to the patient who assumes the risk.

PREPARATION OF THE SURGEON

A realistic approach to the appraisal of risk is obviously necessary and involves not only the item of whether the patient has been prepared adequately for the procedure but also the matter of whether the surgeon's preparation has been adequate. Surgical specialty boards affect to be able to determine what surgeons are proper persons to operate for the relief of certain surgical disorders. And already in consequence of the work they are doing, a noticeable improvement has become discernible in the quality of surgical practice — an impetus that will gain momentum with the years. Yet there are considerations of an intangible nature, relating to the surgeon's preparation, that have an important bearing on the outcome of an operation and are not readily susceptible of analysis. Has the surgeon scheduled more operations than he can conveniently do in the time he has allotted himself? Will he be hurried by prior commitments or appointments that may deter him from carrying out the plan of procedure with the usual care? A recital of such considerations and similar problems familiar to every surgeon can be embarrassing; it is perhaps best that I pursue the inquiry no further. It is to be remembered that surgeons are not immune from the trials of other mortals.

The following words of Portia in the *Merchant of Venice* on such matters are well known:

> If to do were easy as to know what were good to do, chapels had been churches and poor men's cottages princes' palaces. It is a good divine that follows his own instructions. I can easier teach twenty what were good to be done than be one of the twenty to follow mine own teaching.

The qualities of which the surgeon stands in need have been enumerated as "an eagle's eye, a lady's hand and a lion's heart." However far these gifts may go in developing a good surgeon, they are not enough for the difficult surgical tasks of today unless that surgeon is fortunate enough to possess a sturdy pair of legs. Co-ordination of hand and mind is a vital requisite of precise and well performed surgery. Intentness of purpose, complete absorption in the problem at hand and a devoted consecration to his task — these are qualities that help the surgeon to dispel the fatigue and weariness of long and strenuous operative ordeals. There are times, indeed, when the surgeon appears to stand in need of special postoperative treatment: there are operations that tax the surgeon's endurance as much as the patient's ability to withstand them. But as the *Bible* tells us, "The sleep of a labouring man is sweet" and after a night of repose and rest — among the greatest of life's blessings — the surgeon returns refreshed to his labors.

Convalescence without complication is ordinarily synonymous with a well executed operative pro-

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†From the Department of Surgery, University of Minnesota Medical School.

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†Chief, Department of Surgery, University of Minnesota Medical School.

cedure. Critical self-analysis with reference to the surgeon's responsibility for the occurrence of complications is the only rational attitude for the surgeon to assume. A surgeon who is Pollyannish in his attitude to his own accountability for postoperative complications shuns the growth and improvement that result from self-criticism and self-censure. Moreover, there are additional complications, such as thrombophlebitis, embolism, coronary thrombosis and cerebral hemorrhage, for which the surgeon is not strictly accountable, in that they are essentially unavoidable. Unfortunately, no absolute criteria are available to indicate whether or no these complications will occur, although in assuming certain operative risks, the surgeon is fully aware that he is overstepping the borders of convention in his anxiety to bring hope and relief from suffering to his patient.

Preparation of the Dissection

In any operation, preparation of the surgeon is important and implies a satisfactory preparation of the dissection — probably the most vital of all considerations in the safe conduct of a patient through an operation. Although the question of what or whose operation was done is significant, more important still for the immediate success of the procedure is *how* the operation was done. Nice anatomic dissections taking advantage of the knowledge of tissue planes, the careful dissection of blood vessels with minimal loss of blood, the precise placement of sutures and the gentle handling of all tissues — these are the items that ensure the immediate success of an operative procedure and the recovery of the patient. If, on conclusion of the operation, the surgeon is convinced that the objective of the operation was met satisfactorily and that the procedure was in accord with good physiologic principles, the ultimate success of the operation affords real promise of attainment.

No amount of excellent preoperative and postoperative care can make up for an operation that was badly done.

Fortunately, the emphasis on speed is rapidly disappearing from surgery. In another generation the heedless, reckless surgeon who is constrained to emphasize the element of hurry above every other consideration will have disappeared from the scene. And surgery will be the better when, in the memory of active surgeons, such meaningless claptrap phrases as "get in quick and get out quicker" have been completely forgotten. Perhaps we should begin by deletion of the word "theater" as the place where operations are done; operations have ceased to be spectacles, and they are dramatic only so far as they succeed.

The year 1946 marks the centennial of the first public administration of an agent to make operations painless and the coining of the beautiful word "anesthesia" by the medical poet, Oliver Wendell Holmes. Relief from pain during a surgical ordeal — what a gift to humanity! Improved technics of anesthesia, as much as any other consideration, have made it possible to eliminate the element of hurry in operations. The co-ordinated effort of anesthetist and surgeon can make an operation simulate physiologic sleep. There is much yet to be desired in the waking and recovery periods to make them less of a nightmare to the patient. Will the time ever come when an operation will be described as an experience not unlike a pleasant dream? We must of necessity be realists; nevertheless, this is a goal toward which surgeons should turn their eyes.

The use of dry sponges and the weighing scale constitutes an expedient that affords the surgeon satisfactory orientation concerning the extent of the blood loss at any juncture of the operation. To supplant, in kind and in amount, the fluid lost during operation serves to spare the patient the ill effects of protracted lag intervals in therapy.

One factor that bears on the success of operations cannot be stressed too much: deliberate thought and wise planning beforehand. This factor has to do with lessons learned and sometimes painfully in the process of critical self-analysis by realistic surgeons — perhaps best described as practical wisdom, an item on which I shall have more to say presently.

The Synthesis of New Facts

How does it happen that the surgery of today in certain fields can accomplish things that, in the light of the achievement of twenty-five years ago, must be considered no less than miraculous? To be certain, we of today have some new facts at our disposal. And a new fact can change the whole complexion of a problem. New facts, however, are surprisingly few. How many books contain a single new fact? The great impetus to medicine and surgery that comes from a few isolated key facts is astonishing. A general improvement in the tone of practice may be observed: witness what boons to medicine the sulfonamides and penicillin have been.

When the present accomplishment in a given field is compared with that of twenty-five years ago, the gain from the synthesis of known facts is appreciated. This circumstance is encouraging and should serve as a stimulus to all to ferret out from the scientific catacombs of libraries facts that, if known to the person who should be in possession of them, save endless labor and frequently supply the information necessary to the solution of a problem. It does, however, take experience and orientation to profit by reading and study in the interphases of one activity with other specialties. And for many, such vagrant rumination turns out to be wool gathering. Hence, the value of discussion groups such as this. The important thing is for the unknown knowledge to come into the hands of the person who is striving to effect the synthesis.

Pulmonary lobectomy provides an example. This operation was being done for bronchiectasis twenty-five to thirty years ago with an appalling mortality. Today, the same operation is being done in experienced hands in many places with a mortality of 2 per cent or less. Churchill, of this city, was the first to indicate that this potentially formidable procedure could be done at a risk comparable to that for excision of the acutely obstructed but unperforated appendix. This is an accomplishment of no small order. Yet all the essential items involved in the successful performance of this operation were known when the pioneers in the field were making the initial skirmishes with the problem. Now, however, the true significance of the pertinent knowledge relating to the problem has become known to the right persons. It takes time for the meaning of minor differences not apparent on first acquaintance with a problem to be appreciated. In other words, experience has been a great factor in reducing the mortality of pulmonary lobectomy from 50 to 1 or 2 per cent.

There were good surgeons twenty-five years ago, but surgical organization in well appointed hospitals is more efficient today. Anesthesia is considerably better, as is the knowledge of care of patients before and after operation. Surgeons have learned that it takes time and patience to do an operation well, and elimination of hurry by the surgical team has played an important role in the reduction of mortality. Improved nursing care has also been a factor.

Similar progress has been made with many operative procedures. Primary resection of the colon gave way to the exteriorization operation because the surgeon of that day was not ready for primary resection. Today, with a keener appreciation of the elements that are essential for the success of the procedure, well trained surgeons perform primary resection for cancer of the colon with a mortality of 5 per cent or less.

Experience

No less a person than the late Dr. Harvey Cushing put considerable emphasis on the item of experience. In the fall of 1928, I had occasion to spend a week on the stand in his operating room at the Peter Bent Brigham Hospital. Each day he operated for a brain tumor. I marveled at his dexterity and nicety of technic and the facility with which he decided where the tumor was and what area of brain tissue should be excised. On leaving his clinic, I took occasion to thank Doctor Cushing for permitting me to sit in the stand day after day and watch him operate. I asked what the criteria were by which he decided so readily the area and extent of the excision of brain tissue. I was only partially prepared for his answer: "Experience." I then asked if that experience could be resolved in terms of a definition. Dr. Cushing replied again, "Experience." I countered by saying that in a case of breast tumor, such characters as size, hardness and attachment to the skin helped the surgeon to determine the nature of the lesion. I asked if there were any parallel so far as brain tumors were concerned? Dr. Cushing became a bit impatient with my impertinence and said again, "Experience." In the fall of 1934, Dr. Olin West, secretary of the American Medical Association, gave an address at the Wisconsin State Medical Association Meeting at Green Bay, Wisconsin, in which he stated that Dr. Harvey Cushing had emphasized the great value of experience in clinical medicine and had written an article on the subject. Failing to find the article in the *Quarterly Cumulative Index Medicus*, I wrote to Doctor Cushing. He appeared to have remembered the occurrence of 1928 and treated me somewhat more indulgently than when I had accosted him after a long and arduous operation. Although he denied having written philosophically concerning the importance of experience, Dr. Cushing said, "If I spoke of experience, I undoubtedly spoke of technic." The intervening years have confirmed in my mind the truth of his emphasis on the great value of experience.

Preparation of the Patient

The customary technic of preparation of a patient for operation twenty-five years ago consisted essentially in giving a cathartic before operation and in repairing anemia by the transfusion of blood. With the resolution of the mystery that surrounded the cause of death in experimental pyloric and high intestinal obstruction by Gamble and his associates[1, 2] in 1925, light and understanding came into the problem of fluid requirements of patients. During the twenty years that have elapsed, surgeons and other medical specialists have gradually been aroused from their apathy regarding the fluid and electrolyte requirements of patients. Coller and his associates[3, 4] at the University of Michigan, for a period of many years, have been emphasizing the importance of evaluating daily the fluid and electrolyte requirements of surgical patients when the administration is parenteral. It is not long since, in many hospitals, when the fluid given parenterally to any patient was 0.9 per cent saline solution, whether or not glucose was included in the infusion. The hazard of the practice is not difficult to foresee, especially in an older age group of patients, in whom oliguria occurs more readily than in young robust persons. For every 6 gm. of sodium chloride retained, approximately a liter of water is retained. When patients receive 18 to 27 gm. of sodium chloride (2 to 3 liters of saline solution) a day and when their daily requirements, even in the early postoperative phase when abnormal losses must be covered, lie somewhere between 4.5 and 9.0 gm. a day (0.5 to 1 liter of 0.9 per cent saline solution), it is understandable that difficulties arise with the maintenance of fluid and electrolyte balance. In

this connection, it is not out of place to point out too that Coller and his associates,[5] in 1944 revised downward their estimates of sodium chloride needs in the ordinary surgical patient.

The Patient in Good Physical Condition

A patient who enters the hospital for a gastric resection for ulcer or carcinoma who is unobstructed and whose hemoglobin is 12 gm. or better and who has been eating well and has not lost weight needs no special preparation for operation. A careful preoperative diagnostic study, inside or outside the hospital, including evaluation of the patient as an operative risk, is obviously indicated. The same principle holds generally, in my experience, for all conditions that come within the purview of the general surgeon. There are those who insist on several days of preoperative hospitalization, during which succinylsulfathiazole is given to patients expected to undergo resection for cancer of the colon. My thought and practice is to make every effort to effect a satisfactory anastomosis, a single row of interrupted silk sutures sufficing for any anastomosis from the stomach to the rectum. My experience has been that no intestinal antiseptics are necessary in the presence of a satisfactory closed anastomosis. If the anastomosis is unsatisfactory, all the drugs in the pharmacopeia are probably inadequate to correct the situation.

The Poor-Risk Patient

It is in the poor-risk patient that the following four items demand careful consideration: water requirements, electrolyte needs, loss of blood and caloric and nitrogen requirements.

Water and electrolytes. It is convenient to consider together the problems hedging about the administration of fluid and electrolytes to patients before as well as after operation. So much has been written about the fluid and electrolyte needs of patients that it would be out of place for me to restate what others, who have devoted serious study to the matter, have said before. In a sense, it is unwise to consider separately the need of a patient for water and electrolytes: they go hand in hand. When vomiting is absent, the patient slakes his thirst by drinking enough fluid to keep him comfortable. When fluids are administered para-orally, the urine output and the specific gravity of the urine serve as fairly satisfactory guides in determining how much fluid to give. The objective of the surgeon is to keep the patient in fluid and electrolyte balance, sparing him the ill consequences of large contractions or increases in fluid volume. Each morning, when the surgeon and his house staff make ward rounds, the fluid and electrolyte requirements of all patients not hydrating themselves are determined. The weighing scale is a worth-while agency in detecting early departures from the normal status of hydration. The urine output for the preceding twenty-four hours (6 a.m. to 6 a.m.) is noted, together with the specific-gravity determinations of the urine, made by the nurse on the ward on three or four separate specimens. A twenty-four-hour output of 1000 to 1500 cc., with a specific gravity in the range of 1.015 to 1.020, is regarded as optimal. These considerations hold for the period before as well as after operation. A fluid intake of 2500 to 3000 cc. ordinarily takes adequate care of the situation. There is rarely any need to give patients fluid in the form of saline solution on the day of operation. Glucose solutions (5 to 10 per cent) suffice. If an inlying duodenal tube is in place to which suction is being applied, allowance must be made for loss of fluid and electrolytes through such an agency. A good working rule is to estimate the loss of sodium chloride at 5 gm. per liter of gastric aspirations. The hazard of continuing to give saline solution after an inlying duodenal tube has been removed is real. Immediately after operation, owing to the vasodilating effects of anesthesia on the skin capillaries, the loss of water through cutaneous vaporization may be large. The face sheet of the hospital record provides space for all the items to be listed by the nurse. A careful appraisal of these various factors by the surgeon and his house staff once a day ordinarily suffices to keep the situation in hand. In cases in which the urine output for the preceding twenty-four hours falls below 800 to 1000 cc. and the patient's weight varies more than 2 per cent from the preoperative normal, one of the surgical house officers reviews the situation again later in the day to ascertain whether the fluids and electrolytes outlined for the day at morning rounds were satisfactory.

The weighing scale is an important agent in keeping the patient in fluid and electrolyte balance. All patients on my service undergoing major surgery are weighed frequently — on admission and each day before surgery to ascertain the normal weight. The objective of the surgeon after operation is to keep the patient within a fluctuation that does not exceed or fall below the preoperative normal weight by more than 1 or 2 per cent. Fluctuations in weight of more than 3 per cent from the preoperative normal value are few indeed. Yet, strangely enough, such incidents can happen, usually when weighing has been discontinued because believed unnecessary. Constant vigilance on the part of the surgeon and his staff is necessary to obviate this type of occurrence. Gains in weight as well as losses may be observed.

In the normal course of events, a patient will have an indwelling duodenal tube in place after gastric resection for approximately forty-eight hours and after a colic resection for about seventy-two hours. In the postoperative period, the plasma chloride may be determined once or not at all, the urine output and specific gravity and the weight of the patient sufficing to denote a satisfactory status

Fluctuations in weight exceeding 3 per cent of the preoperative normal value suggest the necessity for a closer scrutiny of the situation.

Apart from patients with pneumonia, peritonitis and distention, from whatever cause, in whom the problem of fluid and electrolyte balance is often difficult, the predicament sometimes presents itself unexpectedly in patients who, in spite of a slow convalescence, were believed to have been progressing satisfactorily. The difficulty may be one of overhydration or dehydration. Neglect of weighing such patients is usually responsible for the delay in recognition. Yet, sometimes, especially in patients with complications such as distention, the situation develops so insidiously that the threatening difficulty of gains or losses in weight is not appreciated in time to avert the results of such fluctuations.

Dehydration and electrolyte loss. A loss of 5 to 6 per cent of the body weight, in consequence of abnormal fluid losses, is usually accompanied by recognizable clinical signs of dehydration and hypochloremia. If an inadequate amount of sodium chloride is given and 10 per cent glucose is injected intravenously, a liberal urine output may follow, and dehydration ensues in a few days if this electrolyte loss is not made up. If the fluid loss, responsible for the decrease in body weight, was occasioned by vomiting or suction applied to an inlying duodenal tube, alkalosis will usually follow, owing to a larger loss of the chloride than the sodium ion. In cases in which losses of intestinal secretions from the lower reaches of the bowel, as in diarrhea, are accountable for the contraction in weight, acidosis may occur. In either event, if no renal damage has occurred, saline solution is ordinarily a satisfactory repair agent, as Gamble[6–8] has indicated.

Coller and Maddock[4] suggested that dehydration and electrolyte loss be treated with saline solution, 0.5 gm. of sodium chloride per kilogram of body weight being given for a depression in the plasma chloride of 100 mg. per 100 cc. below the normal value of 560 mg. It has been our practice in this clinic to proceed somewhat more cautiously, not giving nearly so much sodium chloride as is suggested in the Coller–Maddock rule, awaiting manifest evidence of diuresis before attempting to bring the plasma chloride value up to normal. Coller and his associates[5] recently emphasized the so-called "salt intolerance" of sick surgical patients and characterized that clinical rule as "highly inaccurate and dangerous."

Zintel, Rhoads and Ravdin[9] have employed 2 per cent solutions of ammonium chloride intravenously in the correction of alkalosis, believing that restoration of glomerular filtration will be quickened thereby. In the correction of severe acidosis a sixth molar sodium lactate solution[10] or a 5 per cent solution of sodium bicarbonate may be used to restore the normal buffer values in the blood.

Overhydration. Increases in body weight of 3 to 6 per cent may be unaccompanied by symptoms except edema. In old patients, whose physical status is poor, pulmonary edema, pneumonia and heart failure may result from too generous administration of sodium chloride. Not infrequently, when oliguria occurs in such patients, accompanying the retention of water, the plasma chloride may remain low. Efforts to elevate the plasma chloride to a normal value by the administration of added sodium chloride intensify the difficulty. The usual initial provoking cause of the abnormal water retention and gain in weight in these patients is administration of more sodium chloride than the patient requires. Moreover, sodium chloride retention appears to occur in pneumonia[11] and in peritonitic states accompanied by intestinal distention. And, owing to impaired glomerular filtration,[12] severe oliguria may be present despite the fact that the body weight is above normal. In such cases, when the weight is 4 to 6 per cent or more above the initial normal level, I have contented myself with the slow intravenous administration of 800 to 1000 cc. of a 50 per cent glucose solution a day, giving enough glucose to meet the basal caloric needs. The recovery from pneumonia, pulmonary edema and heart failure in such patients following the correction of the overhydration is often remarkable. There are mortality and morbidity of treatment, as well as of the disease process. And it is important to attempt to know which is which. When diuresis commences in such oliguric edematous patients, following fluid and sodium chloride retention, lesser concentrations of glucose with larger amounts of water may be given. For patients who have become oliguric or anuric because of renal damage from sulfonamide administration or a transfusion reaction, the dialysis of retained urea through the peritoneum by perfusion appears to be promising.[13]

Many of the situations that Jones and Eaton[14] described in their excellent paper on nutritional edema were undoubtedly due to the excessive administration of sodium chloride. And whereas this agency, together with hypoproteinemia, may be a likely theoretical causal factor in bringing about obstruction at the efferent outlet after gastrojejunal anastomoses, I consider this item far less significant than overinversion of tissue by the surgeon in the making of the anastomosis.[15] Early dismissal of patients from the hospital after gastrointestinal anastomoses of every kind is contingent on the making of satisfactory anastomoses that do not obstruct. It is time that surgeons appreciate that they themselves, in making imperfect anastomoses with overinversion of tissue, invite obstruction at the new stoma.

The Weighing Scale

Its accuracy in evaluating hydration. For more than six years, in our clinic, the weighing scale has

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Coller and Maddock[4] suggested that dehydration and electrolyte loss be treated with saline solution, 0.5 gm. of sodium chloride per kilogram of body weight being given for a depression in the plasma chloride of 100 mg. per 100 cc. below the normal value of 560 mg. It has been our practice in this clinic to proceed somewhat more cautiously, not giving nearly so much sodium chloride as is suggested in the Coller–Maddock rule, awaiting manifest evidence of diuresis before attempting to bring the plasma chloride value up to normal. Coller and his associates[5] recently emphasized the so-called "salt intolerance" of sick surgical patients and characterized that clinical rule as "highly inaccurate and dangerous."

Zintel, Rhoads and Ravdin[9] have employed 2 per cent solutions of ammonium chloride intravenously in the correction of alkalosis, believing that restoration of glomerular filtration will be quickened thereby. In the correction of severe acidosis a sixth molar sodium lactate solution[10] or a 5 per cent solution of sodium bicarbonate may be used to restore the normal buffer values in the blood.

Overhydration. Increases in body weight of 3 to 6 per cent may be unaccompanied by symptoms except edema. In old patients, whose physical status is poor, pulmonary edema, pneumonia and heart failure may result from too generous administration of sodium chloride. Not infrequently, when oliguria occurs in such patients, accompanying the retention of water, the plasma chloride may remain low. Efforts to elevate the plasma chloride to a normal value by the administration of added sodium chloride intensify the difficulty. The usual initial provoking cause of the abnormal water retention and gain in weight in these patients is administration of more sodium chloride than the patient requires. Moreover, sodium chloride retention appears to occur in pneumonia[11] and in peritonitic states accompanied by intestinal distention. And, owing to impaired glomerular filtration,[12] severe oliguria may be present despite the fact that the body weight is above normal. In such cases, when the weight is 4 to 6 per cent or more above the initial normal level, I have contented myself with the slow intravenous administration of 800 to 1000 cc. of a 50 per cent glucose solution a day, giving enough glucose to meet the basal caloric needs. The recovery from pneumonia, pulmonary edema and heart failure in such patients following the correction of the overhydration is often remarkable. There are mortality and morbidity of treatment, as well as of the disease process. And it is important to attempt to know which is which. When diuresis commences in such oliguric edematous patients, following fluid and sodium chloride retention, lesser concentrations of glucose with larger amounts of water may be given. For patients who have become oliguric or anuric because of renal damage from sulfonamide administration or a transfusion reaction, the dialysis of retained urea through the peritoneum by perfusion appears to be promising.[13]

Many of the situations that Jones and Eaton[14] described in their excellent paper on nutritional edema were undoubtedly due to the excessive administration of sodium chloride. And whereas this agency, together with hypoproteinemia, may be a likely theoretical causal factor in bringing about obstruction at the efferent outlet after gastrojejunal anastomoses, I consider this item far less significant than overinversion of tissue by the surgeon in the making of the anastomosis.[15] Early dismissal of patients from the hospital after gastrointestinal anastomoses of every kind is contingent on the making of satisfactory anastomoses that do not obstruct. It is time that surgeons appreciate that they themselves, in making imperfect anastomoses with overinversion of tissue, invite obstruction at the new stoma.

The Weighing Scale

Its accuracy in evaluating hydration. For more than six years, in our clinic, the weighing scale has

been employed as a matter of routine in computing fluid balance. Our experience suggests that the weighing scale is superior to other procedures in ascertaining early departures from the normal status of hydration in postoperative patients. In the weighing of patients the method can be carried out to an accuracy of about 100 gm. In a patient weighing 70 kg. this figure represents 0.14 per cent of the body weight; in a patient weighing 50 kg., a margin of 100 gm. in the accuracy of the method amounts to 0.20 per cent of the total weight. Since only changes ascribable to likely differences in the weight of body water are involved in attempting to follow the status of hydration with the weighing scale, employing the factor of 70 per cent of body weight as water, the accuracy indexes for patients weighing respectively 70 and 50 kg. are 0.20 and 0.29 per cent.

For observations of an experimental nature, it is preferable to have a scale that weighs to an accuracy of approximately 5 gm. For clinical purposes, however, the ordinary weighing scale suffices. Over the short interval during the postoperative period, when the weighing scale is being employed to gauge the status of hydration, the error introduced, by assuming that observed changes in body weight represent differences in body hydration, is probably small indeed. The basal caloric requirements of the patient after operation are almost met by the daily intravenous administration of 3000 to 3500 cc. of 10 per cent glucose solution. And the urinary nitrogen loss under these circumstances is ordinarily not large, especially when small amounts of plasma are given intravenously each day in an attempt to cover the protein demands of the body.

If the surgeon is relying principally on changes in the hemoglobin to afford the same orientation, it is obvious that this method is by no means so delicate as the weighing scales. A change of 1 gm. in the hemoglobin from a previous determination of 13.5 gm. suggests a 7.5 per cent alteration in hydration — a figure that is synonymous with severe dehydration or overhydration. Fluctuations of hemoglobin determinations in the normal patient in the range of 5 to 10 per cent are frequent enough in the experience of clinicians to suggest that adjudication of the status of hydration by changes in hemoglobin is not reliable, especially in detecting early or lesser variations in hydration. And it is just such early departures from the normal that the surgeon should be apprised of in following the status of hydration of his patient in an intelligent manner. It is fair to suggest that the weighing scale is probably twenty-five to fifty times more sensitive than the hemoglobin determination in the detection of minor changes in body hydration in postoperative patients.

In addition to the circumstance of greater accuracy over other available methods in determining the status of hydration, the weighing scale has the advantage of simplicity. Its chief virtue lies, however, in affording a prevision of what will happen if abnormal losses or increases in body weight are not avoided.

Why have clinicians not adopted this device earlier to aid them in ascertaining the status of hydration of their patients? When will the weighing of cardiac patients become standard practice as a guide to therapy? In how many patients with urinary obstruction is the uremia observed after transurethral resection in reality extrarenal, owing to disorientation on the part of the surgeon in attempting to regulate fluid and electrolyte balance? Such patients as a group, because of their age and debility, are probably especially susceptible to errors in fluid therapy. Certainly, postoperative uremia is frequently observed among patients who were not uremic prior to operation. Is this circumstance inherent in the disease process, or is it a complication of therapy?

It is a frequent weakness to ask others to do what we might do better for ourselves. To this frailty, surgeons are no exception. We could weigh our patients, gaining thereby first-hand information relative to the status of hydration. But the laboratory will do this for us. We could examine the patient ourselves, but a note in the consultation basket to the medical staff will accomplish that objective more readily. We could make our own diagnoses, but why bother when we have roentgenologists and pathologists to make them for us? Have surgeons improved their technic by this sluggish indifference to some of their own important problems? When will they awaken from their torpid lethargy to a realization that they alone can significantly influence their own development? Other medical specialists are too occupied with their own problems to take a vital interest in ours. It is time that we grasp the necessity of helping ourselves out of some of our own difficulties. General recognition of the value of weighing patients will help the surgeon in his wrestle with the problem of hydration. Moreover, it is probably the best instructional agency in making a staff of both surgeons and nurses conscious of hydration. Of course, in many cases this extra labor is unnecessary. But who knows when this information will be at a premium? And who counts the cost of labor when lives are at stake? The time will certainly come when weighing patients will be as much a part of hospital procedure as taking the patient's temperature. Only time and patience, however, can overcome so powerful a force as the apathy of inertia.

Technic. With the adoption of early ambulation of postoperative surgical patients as a frequent practice, most patients, on the day following operation, — even after major abdominal procedures, — are asked to stand on an ordinary portable scale brought to the bedside. Until recently, when patients returned from the operating room, they were lifted onto a Red Cross litter carrier, placed on an elevated block or platform on the same type of

portable scale. A few months ago, Mr. John A. Phelan, of the Scientific Apparatus Shop in the University of Minnesota, built for me a portable, bedside scale that permits weighing of the patient in bed (Fig. 1). An electrically driven motor elevates the patient in a hammock above the level of the bed (Fig. 2). This type of scale promises to prove helpful in dealing with sick patients. Weighing scales, like other apparatus, may go out of order and periodic checks for accuracy are imperative.

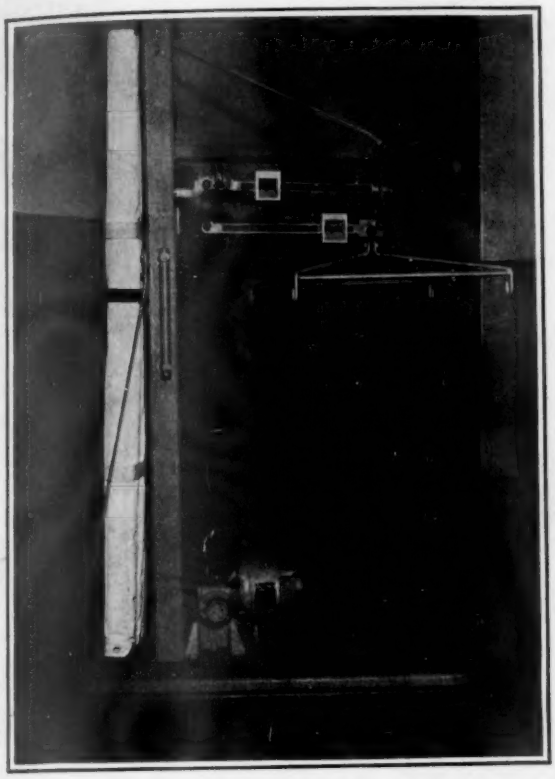

FIGURE 1. *Scale Employed for Weighing the Patient in Bed.*

EXCHANGES BETWEEN THE INTRACELLULAR AND EXTRACELLULAR FLUID COMPARTMENTS

Hastings and Eichelberger[16] observed that liberal amounts of normal saline solution injected intravenously into dogs caused a 48-gm. gain per kilogram of muscle, detectable an hour after completion of the injection. In these experiments the dogs received 170 cc. of saline solution (125 mg. of sodium chloride and 25 mg. of bicarbonate of soda) per kilogram. When, in addition, the hydrogen ion concentration was altered by the production of alkalosis employing a solution containing 114 mg. of sodium chloride and 40 mg. of bicarbonate of soda, the gain in weight per kilogram of muscle was 126 gm., of which amount the authors calculated the gain as 85 gm. in extracellular fluid and 41 gm. in intracellular. In other words, gains or losses in fluid sustained by the body are partitioned quickly, in all likelihood according to a certain pattern, throughout the fluid-containing compartments of the body.

In studying dehydration Wiley and Wiley[17] indicated that slight dehydration not exceeding 1.5 per cent of the body weight is probably unaccompanied by any great disturbance of the electrolyte balance. Inasmuch as 70 per cent of the body water is contained within tissue cells, it is apparent that ultimate fluctuations in the status of hydration of patients are due to contraction or swelling within them. Unfortunately, no direct means are available with which to measure changes in the intracellular fluid compartment, except so far as these changes are reflected in the extracellular fluids.

BLOOD LOSS

The employment of dry sponges that are weighed during operation permits the surgeon opportunity to inform himself concerning the extent of blood loss throughout the procedure. Only large packs in contact with the bowel are kept moist to keep fibrin formation at a minimum. The gain in weight of the sponges, passed back to be counted by the circulating room nurse, is calculated as blood loss, even though such gains in operations in the peritoneal and thoracic cavities are due in part to absorption of fluid other than blood. This scheme of calculating blood loss during operation has been in use in our operating rooms for somewhat more than four years.[18] The plan has proved helpful, and a comparison with the usual colorimetric method for determining the blood loss suggests that this simple gravimetric method is quite accurate.[19]

In replacing fluid losses, there is no better rule than to replace in kind and in amount. In operations in which the anticipated blood loss is expected to exceed 500 cc., blood is always available for transfusion. In every major operative procedure, a needle should be placed in an ankle vein at the beginning of the operation, to permit the administration of glucose solution and blood or plasma if need be during operation. For blood losses in excess of 500 cc., there is no satisfactory substitute for the blood loss other than blood.

MAINTENANCE OF CALORIC AND NITROGEN EQUILIBRIUM

Within recent years, surgeons have become increasingly aware of the great importance of ascertaining the nutritional status of their patients prior to operation. It is not enough to make certain that the hemoglobin value is satisfactory and that the patient is in fluid and electrolyte balance. Patients whose food intake has been poor and who have lost considerable weight and, in consequence, have become autocannibalistic are poor subjects for operation. The protein stores of such patients have been depleted, and fatty infiltration of the liver is a usual sequel. The tolerance of such patients for

operation is poor. My associate, Dr. R. L. Varco,[20] has made a special study of the preparation of such patients for operation, and the lessons learned in this clinic regarding adequate preoperative preparation may prove helpful to others. What the proper feeding of such starved and debilitated patients will accomplish is sometimes difficult to believe. A bedridden patient who can scarcely sit or stand may, with proper preoperative feeding, be rehabilitated to withstand severe operative ordeals. The extent of the weight loss is, in the main, the best criterion of the length of preoperative feeding period. Patients without pyloric obstruction may be fed with the intragastric drip of a feeding mixture rich in protein and carbohydrate and low in fat (the Varco II diet).

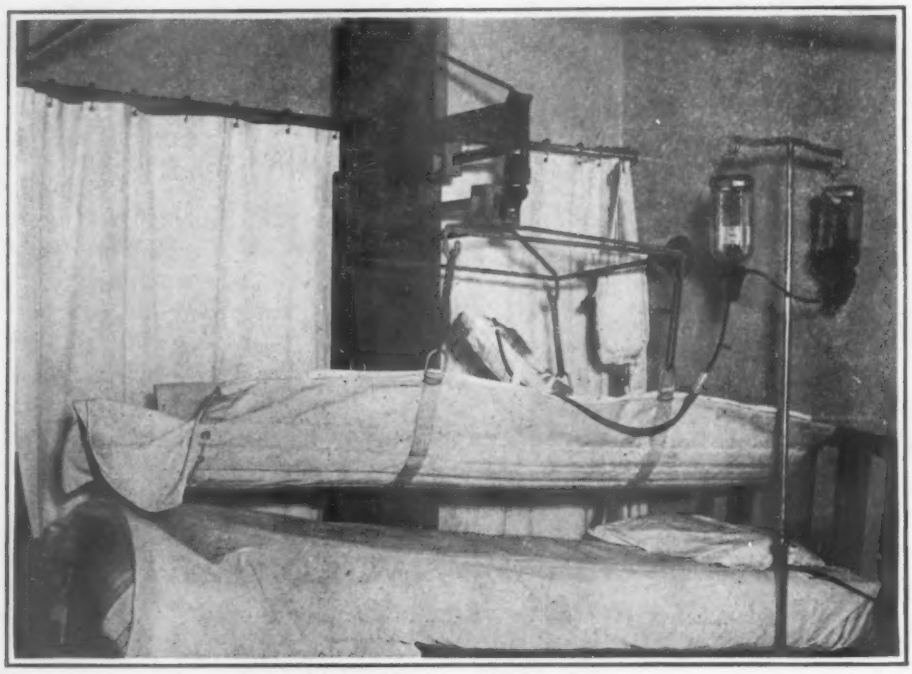

FIGURE 2. *The Scale in Use.*

The motor on the platform (Fig. 1) has elevated the patient above the level of the bed. Neither the administration of intravenous fluid nor the suction applied to the indwelling duodenal tube is disturbed.

If a patient is able to eat, he may drink the mixture or take it through a sipper.[21] For patients with pyloric obstruction, the preoperative preparation must be accomplished by the intravenous feedings of amino acids, plasma and glucose. Obviously, the oral route permits a more adequate and satisfactory preoperative preparation. Yet we have found preliminary enterostomy for feeding purposes unnecessary in the presence of pyloric obstruction, intravenous feeding sufficing to permit a one-stage operation.

VITAMINS

Studies on the poor healing quality of tissues in patients with vitamin C depletion suggest that all poor-risk patients be given adequate amounts of the vitamin prior to operation. Vitamin K, in the preparation of patients with obstructive jaundice, has been a great boon in doing away with the hazard of postoperative bleeding in such cases. Poor-risk patients being prepared for major operative procedures, as well as in the early postoperative period, are given daily with the intravenous fluids an ampoule of crude liver extract (Campolon) and 100 mg. of vitamin C. No attempt has been made to repair other likely coexisting vitamin deficiencies.

SPECIAL POSTOPERATIVE PROCEDURES

The employment of inhalation anesthesia has been standard practice in our clinic. The importance of the careful handling of an unconscious patient can not be overemphasized. He should be conveyed from the operating room in moderate Trendelenburg position to encourage the gravitation of tracheal mucus or fluid into the pharynx, where it may readily be aspirated. Until the patient is wide awake and can deal satisfactorily with secretions that accumulate in the mouth, it is essential to provide for their removal. The use of a moderately steep Trendelenburg position during the waking period and an electric-suction device, operated by an experienced nurse oriented in the problems of the hazards of aspirated oral secretions, meets the needs of the situation. Intelligent bedside nursing care is a vital desideratum in the safe conduct of a patient through a major operative procedure.

It is unwise to permit patients to struggle unduly during the waking period. I have the impression that patients with poor cardiac reserve often do not tolerate such struggling. I have seen at least one case — that of a patient with an antecedent coronary thrombosis — in which violent, uncontrolled struggling for a few minutes during the waking period was followed by sudden death. In any case such violent exertion on the part of a semiconscious patient is productive of no good. When this circumstance arises, our nurses are instructed to give a small dose of Pentothal through the tubing leading to the ankle vein, into which the intravenous drip of glucose solution begun at the commencement of the operation is still running. Such postponement of waking lessens the excitement of recovery from the effects of the anesthetic and affords the nurse time to cover the oncoming pain with a suitable dose of narcotic.

Regurgitation into the lungs is the most frequent cause of pneumonia whether such fluid comes from the stomach or is aspirated into the lungs from secretions in the mouth during the early phase of the recovery period.[22] Keeping the stomach empty during and after operation by suction applied to an indwelling duodenal tube is therefore essential. Moreover, this practice is the best prophylaxis against intestinal distention, which frequently attends abdominal operation. The avoidance of distention and continued elevation of the legs above the level of the heart, together with active leg motion by the patient for the first few days during the recovery period, are important items in the return of venous blood from the lower extremities and in preventing venous stasis and thus helping to thwart the formation of thrombi in the leg veins and their propagation as emboli.

Early ambulation of patients after operation quickens recovery and lessens the length of hospital stay. Recovery without complication is compounded of satisfactory preparation of the surgeon and the dissection and the care of the patient before and after operation. Simultaneous performance of multiple operations, such as gastric resection, cholecystectomy and appendectomy or gastric resection and partial colectomy, is well tolerated if nothing is left to chance in any part of the operative procedures. A smooth convalescence is synonymous with recovery and permits early dismissal from the hospital. It is not unusual for patients to leave the hospital five days after a gastric resection when the precepts of a well conducted operative procedure have been observed.

Summary

The safe conduct of the patient through operation demands proper preparation of the surgeon, careful and precise preparation of the dissection and evaluation of the patient's condition for operation, including satisfactory preparation for the operative procedure and watchful and intelligent care and observation through the convalescent period.

In the evaluation and maintenance of a proper fluid and electrolyte balance during the recovery period, the importance of the weighing scale is emphasized. It is believed that the routine weighing of patients undergoing major operative procedures that require the parenteral administration of fluid will materially reduce the incidence of errors in fluid therapy. In the early detection of deflection from the normal status of hydration, the weighing scale is probably twenty-five to fifty times more sensitive than changes in the hemoglobin in previsioning the occurrence of threatening disaster to the patient occasioned by unwise administration of fluid and electrolytes. A method of weighing patients in bed after operation is described.

The success of operative procedures is a blend of many things, sovereign among which is a consecrated devotion to his tasks by the surgeon, together with a capacity for detection and critical analysis of the source and accountability of errors.

References

1. Gamble, J. L., and Ross, S. G. Factors in dehydration following pyloric obstruction. *J. Clin. Investigation* **1**:403-423, 1925.
2. Gamble, J. L., and McIver, M. A. Effects of pyloric obstruction in rabbits. *J. Clin. Investigation* **1**:531-545, 1925.
3. Coller, F. A., Bartlett, R. M., Bingham, D. L. C., Maddock, W. G., and Pederson, S. Replacement of sodium chloride in surgical patients. *Ann. Surg.* **108**:769-782, 1938.
4. Coller, F. A., and Maddock, W. G. Water and electrolyte balance. *Surg., Gynec. & Obst.* **70**:340-354, 1940.
5. Coller, F. A., Campbell, K. V., Vaughan, H. H., Iob, V., and Moyer, C. A. Postoperative salt intolerance. *Ann. Surg.* **119**:533-542, 1944.
6. Gamble, J. L. Extracellular fluid: extracellular fluid and its vicissitudes. *Bull. Johns Hopkins Hosp.* **61**:151-173, 1937.
7. *Idem.* Extracellular fluid: renal defense of extracellular fluid: control of acid-base excretion and factors of water expenditure. *Bull. Johns Hopkins Hosp.* **61**:174-197, 1937.
8. *Idem. Chemical Anatomy, Physiology and Pathology of Extracellular Fluid: A lecture syllabus.* Boston: Spaulding-Moss, 1939.
9. Zintel, H. A., Rhoads, J. E., and Ravdin, I. S. Use of intravenous ammonium chloride in treatment of alkalosis. *Surgery* **14**:728-731, 1943.
10. Hartmann, A. F., and Senn, M. J. E. Studies in metabolism of sodium *r*-lactate. II. Response of human subjects with acidosis to intravenous injection of sodium *r*-lactate. *J. Clin. Investigation* **11**:337-344, 1932.
11. Wilder, T. S., and Drake, T. G. H. Metabolism of chloride and total fixed base in pneumonia and relation to salt and water retention. *J. Clin. Investigation* **7**:353-364, 1929.
12. McCance, R. A., and Widdowson, E. M. Secretion of urine in man during experimental salt deficiency. *J. Physiol.* **91**:222-231, 1937.
13. Frank, H. A., Seligman, A. M., and Fine, J. Treatment of uremia after acute renal failure by peritoneal irrigation. *J. A. M. A.* **130**: 703-705, 1946.
14. Jones, C. M., and Eaton, F. B. Postoperative nutritional edema. *Arch. Surg.* **27**:159-177, 1933.
15. Wangensteen, O. H. Cause and prevention of stomal obstruction in gastrojejunal anastomoses: gastric resection and gastrojejunostomy. *H. Brunn, Med.-Surg. Tributes*, pp. 551-562, 1942.
16. Hastings, A. B., and Eichelberger, L. Exchange of salt and water between muscle and blood. I. Effect of increase in total body water produced by intravenous injection of isotonic salt solutions. *J. Biol. Chem.* **117**:73-93, 1937.
17. Wiley, F. H., and Wiley, L. L. Inorganic salt balance during dehydration and recovery. *J. Biol. Chem.* **101**:83-92, 1933.
18. Wangensteen, O. H. Controlled administration of fluid to surgical patients including description of gravimetric methods of determining status of hydration and blood loss during operation. *Minnesota Med.* **25**:783-789, 1942.
19. Baronofsky, I. D., Treloar, A. E., and Wangensteen, O. H. Blood loss in operations: statistical comparison of losses as determined by gravimetric and colorimetric methods. *Surgery* **20**:761-769, 1946.
20. Varco, R. L. Preoperative dietary management for surgical patients: with special reference to lesions of stomach and duodenum. *Surgery* **19**:303-378, 1946.
21. Wangensteen, O. H. Abdominal surgery in old age, including comment on use of sipper; safety of multiple simultaneous operations; mechanism of development of "bed sores." *Journal-Lancet* **64**: 178-183, 1944.
22. *Idem. Intestinal Obstructions: A physiological and clinical consideration with emphasis on therapy, including description of operative procedures.* Second edition. 484 pp. Springfield, Illinois: Charles C Thomas, 1942.

AUTOPSY SERVICE AT THE MARY HITCHCOCK MEMORIAL HOSPITAL*

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IN 1932 the Mary Hitchcock Memorial Hospital staff established standard autopsy procedures that have led to a consistently high percentage of permissions for post-mortem examination. The essential features of the program are as follows:

A hospital staff that agrees that all deaths be followed by a request for post-mortem examination. Precedence is given to the obtaining of permission for autopsy because of the fleeting nature of the opportunity to give a valuable service to the family of the deceased — I have never known a family to be antagonized by a request for autopsy.

A department of pathology ready to perform an autopsy at any hour of the day or night required by the circumstances. The effort required of the physician to obtain permission justifies an equal effort on the part of the pathologist to avoid delay and secure fresh material.

A public that is informed concerning the value of autopsy. Discussion of the facts of the case, particularly at the time immediately following autopsy, gives the pathologist an opportunity to answer many questions that, if left unanswered for long, may leave relatives in a puzzled frame of mind and cause them to seek the answers elsewhere. Following such an interview, the relatives are referred to the family physician, to whom a final complete report is sent.

A co-operative group of funeral directors. Frequent contact is required to determine possible improvements in technic or schedule and thus to avoid interfering with the funeral director's obligations to the family.

The continuity of the program is maintained by presenting to each new member of the staff the following statement:

An Approach to Securing Autopsy Permission

Autopsy percentage will be considered satisfactory when it reaches 100 per cent. Autopsies are done only after permission of the nearest relative or responsible person has been obtained, preferably by interview. It is important that relatives be aware of the following features of the autopsy service:

1. **Autopsies are made without charge at considerable expense to give all concerned valuable information not otherwise obtainable.**
2. **Autopsies are done discreetly in such a manner as to avoid disfigurement of the body so far as the funeral is concerned. The method of autopsy makes better embalming possible for a competent embalmer.**
3. **Relatives should be assured that autopsy does not necessitate delay.**

The purpose of the program was to approach as nearly as possible complete analysis of all hospital deaths. The results have been encouraging. Autopsies had been done in the region by medical-school physicians for many years — the percentage during those years is not a matter of record, but it was certainly low. Interest in autopsies, even without a formal program, resulted in an increase from less than 10 per cent (estimated) in 1926 to about 60 per cent after three years. The rise in the curve from this 60 per cent plateau followed the agreement of the staff members concerning the program and their complete co-operation in carrying it out.

In the twelve-year period 1932-1944, the Mary Hitchcock Memorial Hospital admitted a total of 40,326 patients. Figure 1 presents the autopsy percentages. Table 1 indicates the sex distribution of patients admitted, patients dying in the hospital and patients autopsied. This distribution suggests that permission for autopsy is obtained with the same ease whether the patient is male or female. House[1] has analyzed and published elsewhere the data concerning most of these cases. The principal causes of death, exclusive of stillbirth, in 488 cases of the series of 1091 autopsies were as follows: hypertensive cardiovascular renal disease, 85 cases; coronary-artery sclerosis, 57 cases; rheumatic heart disease, 51 cases; carcinoma of large intestine, 46 cases; suppurative appendicitis, 32 cases; lobar pneumonia, 28 cases; pulmonary embolism, 25 cases; benign hypertrophy of prostate gland, 24 cases; subacute bacterial endocarditis, 20 cases;

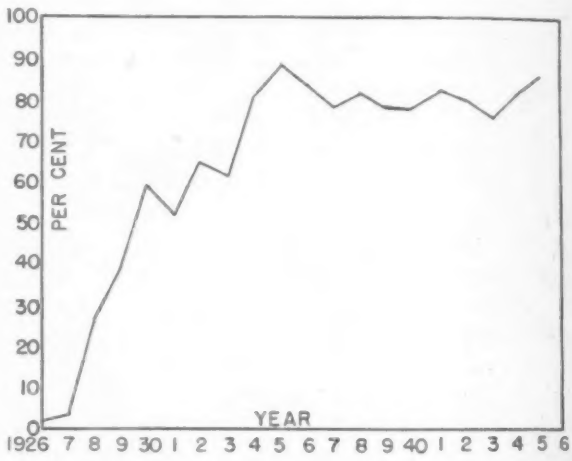

FIGURE 1. *Curve of Percentages of Autopsies in Relation to Deaths (Mary Hitchcock Memorial Hospital, 1926-1945).*

*Presented at the annual meeting of the New Hampshire Medical Society, Manchester, May 14, 1946.

From the Department of Pathology, Dartmouth Medical School.

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peptic ulcer, 19 cases; carcinoma of lung, 16 cases; carcinoma of stomach, 16 cases; pulmonary tuberculosis, 15 cases; suppurative meningitis, 13 cases; cirrhosis of liver, 11 cases; carcinoma of prostate, 10 cases; carcinoma of bladder, 10 cases; and carcinoma of breast, 10 cases.

About 50 per cent of the deaths occurred on the medical service, 35 per cent on the surgical and 13 per cent on the pediatric. The deaths were obstetric in only 1 per cent. Patient days in the hospital were distributed in about equal proportion between medical and surgical cases, which together comprised about half the total. Pediatric cases accounted for 15 per cent and obstetric cases for 7 per cent of the total patient days.

TABLE 1. *Data on Admissions, Deaths and Autopsies at Mary Hitchcock Memorial Hospital (1932-1944).*

DATUM	MALES	FEMALES	TOTALS	RATIO OF MALES TO FEMALES
Admissions	17,775	22,551	40,326	0.8
Deaths	812 (4.75%)	547 (2.63%)	1,359 (3.36%)	1.5
Autopsies	653	438	1,091	1.5

A comparison of the age distribution of this group with that of all fatal cases in a large metropolitan region shows a correlation in some decades.[2] The percentage of deaths was highest in the first and lowest in the fifth decade in the group at the Mary Hitchcock Memorial Hospital, probably because the cases consisted solely of hospitalized patients. Infants born in the hospital contributed largely to the group of cases in which autopsy was performed in the first decade of life, accounting for nearly one tenth of the autopsies in this series.

The over-all importance of cancer as a fatal disease is indicated in this series, in which about one fifth of the deaths were due to cancer. If the cancerous diseases of the hemolymph system are grouped, they are second only to cancer of the large intestine in numerical importance.

Certain trends indicate that hospital death statistics cannot be compared with general death-certificate data. The development of special services within a hospital is shortly reflected in the autopsy service. Changing therapies lead to increasing or decreasing hospitalization within a group. For the same reasons, comparison of data of different hospitals is difficult.

The numerical significance of such a series is so slight that the chief values of the service and analyses obviously accrue to the hospital and staff concerned. The purpose of this analysis and presentation is to emphasize the fact that, despite the lack of great contribution to general statistics, valuable information is afforded by routine autopsies to the small hospital and to medical groups that cannot be obtained in any other way.

This report includes only the data accumulated at the Mary Hitchcock Memorial Hospital. The consistently high percentage of examinations, however, is considered to be due in part to the program throughout the area. There has been co-operation of the small hospitals in the community, the Mary Hitchcock Memorial Hospital and the Dartmouth Medical School to achieve as high as 50 per cent of autopsies in individual small hospitals and in one physician's rural practice.[3] During the period covered, autopsies have been done in and for ten participating institutions. Analysis of this series is in progress.

CONCLUSIONS

Autopsies should be a matter of routine. Only when the public is familiar with the value of autopsies will permissions be granted in a high percentage of cases.

Cases should not be selected for their "interest." Such selection defeats many of the purposes of the autopsy.

Autopsy statistics are of little value as statistics unless a high percentage of deaths are followed by autopsies that are routine.

Autopsies done in a high percentage of cases yield many valuable data not obtainable otherwise.

REFERENCES

1. House, R. K. Review of autopsy service in small rural hospital. *J. Tech. Methods and Bull. Internat. A. Med. Museums.* No. 25 (December), 148, 1945.
2. Duffield, T. J. Vital statistics, City of New York Department of Health, 1933-1936.
3. Putnam, W. F. Post-mortem examination in rural general practice. *New Eng. J. Med.* 224:324-328, 1941.

PENICILLIN INHALATION THERAPY*

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INHALATION therapy has attained amazing prominence since the ancient and empirical practice of inhaling medicated vapors. In a report on the use of oxygen, helium and oxygen mixtures and aerosolized sprays of various therapeutic agents for the maintenance of respiratory function, the use of penicillin aerosol was suggested.[1] Barach and his associates[2, 3] first described the technic and the value of continued vaporization of various drugs with oxygen streams. Castex et al.,[4, 5] Krueger et al.[6, 7] and Mutch[8] demonstrated that aerosolized substances penetrate to the outermost air sacs of the lungs and to the ends of the bronchial tree.

The physiologic rationale of penicillin aerosol therapy has been well established. Bryson et al.[9] demonstrated that penicillin aerosol penetrated the lungs, diffused into the blood stream and was excreted in the urine. Barach and his associates[10–14] confirmed these observations in a group of patients with bronchopulmonary disease and developed the proper equipment and technic for penicillin aerosol therapy. In a detailed investigation of the fate of aerosols in the lungs, Mutch and Rewell[15] further proved the efficacy of the therapy. They suggested the use of penicillin aerosol in the management of purulent bronchitis and bronchiectasis and as a prophylactic against secondary pyococcal infection in influenza. Knott and Clark[16] carried these studies farther, demonstrating effective bacteriostasis in closed chambers and suggesting a technic for the control of airborne infections. Other investigators[17–21] have employed penicillin aerosol with encouraging results in the management of pulmonary infections. In most cases effective therapeutic blood levels and excellent topical effects have been obtained.

This report concerns a summary of our findings in the use of penicillin aerosol in the treatment of 85 patients with bacterial pneumonia, suppurative bronchitis, bronchiectasis, lung abscess, infective bronchial asthma, infective laryngotracheobronchial edema, chronic pulmonary emphysema and emphysematous blebs.

TECHNIC

The control of infection by penicillin is dependent on the susceptibility of the bacteria, the resistance of the strain responsible for the infection, the duration of exposure of the organism to an effective local concentration of penicillin and the attainment of an adequate concentration of penicillin in the blood to penetrate the dense inflammatory foci in which the bacteria are embedded; the maintenance of such a constant high level is not essential in purely local pulmonary infections without bacteriemia. Topical penicillin levels can be attained by the administration of concentrated doses six times daily. In patients with toxemia or septicemia additional intramuscular doses, five or six times daily, may help in producing blood levels sufficiently high to clear the blood stream of bacteria. Infections of the lung, which usually occur in well vascularized soft tissues, generally respond to concentrations of penicillin that are completely ineffective in the relatively avascular hard tissues.

The patients with pneumococcal pneumonia were treated for three to seven days, those with bronchiectasis or lung abscess, for seven days prior to surgery or for six weeks for purely medical therapy, those with infective bronchial asthma, from three days through three weeks, and those with streptococcal or staphylococcal pneumonia complicated by abscess formation, generally for a minimum of three or four weeks. The other patients were treated until there was no further evidence of infection and the penicillin-susceptible organisms had been eradicated.

The sodium or calcium salt of penicillin was used. Generally 25,000 units of penicillin were dissolved in 1.0 cc. of physiologic saline solution and given at three-hour intervals for six to eight doses daily. The patients with pneumococcal pneumonia and those with acute or chronic sinusitis generally received 25,000 units at two-hour intervals for six doses and at three-hour intervals thereafter. The patients with the more serious types of pneumonia and lung abscesses received 50,000 units in 2.0 cc. of physiologic saline solution. These patients were able to take with complete tolerance 50,000 or even 100,000 units by the nasal route.

The calcium salt was less irritating but was usually more difficult to obtain than the sodium. The ampoules containing 200,000 units were of more practical value. Many patients objected to the taste and smell of the penicillin aerosol or found it irritating to the tongue or oropharynx. These complaints were minimized by a change to other lots of penicillin. A few patients developed sore tongues or stomatitis following the therapy. Saline rinses, dental hygiene and frequent sips of water during the treatment helped to diminish these complaints.

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†Assistant professor of medicine, Tufts College Medical School; director of inhalation therapy, Boston City Hospital.

‡Formerly, outpatient physician, Boston City Hospital.

In an earlier series of cases no systemic, toxic or allergic manifestations were observed.[22–24] More recently, however, we have noted local and generalized manifestations consisting of edema of the lips or the mucosa of the mouth and, in several cases, a generalized urticaria. The local reactions generally subsided after a change to another type of penicillin. The urticaria in 1 case cleared up promptly when treatment ceased and did not return when a different lot of penicillin was used. In a recent case with complicating urticaria we were able to continue with the same lot of penicillin by adding oral benadryl; this new synthetic antihistamine agent was apparently of value.

The apparatus used in our studies was the basic Vaponefrin nebulizer* enlarged to a capacity of 2 liters to permit the utilization of the expired penicillin. This nebulizer produced a fine, voluminous mist or smoke screen with a particulate size of less than 1 micron. A piece of rubber tubing connected the nebulizer with a regulator attached to an oxygen tank. Oxygen flows of 5 to 7 liters were usually sufficient to aerosolize 1.0 cc. of the penicillin solution in approximately fifteen minutes. To avoid loss of the drug in expiration, a glass Y tube was placed just proximal to the inlet of the nebulizer. The patient or nurse was instructed to close the open end with a finger during most of the inspiratory cycle and to remove the finger at the end of inspiration and during the entire expiration. With this technic the oxygen bypassed the nebulizer in the expiratory phase of respiration and no appreciable penicillin was lost through the top carburetor opening of the nebulizer. In the severest cases an automatic device perfected by Emerson delivered the penicillin aerosol during the inspiratory cycle by modifying a demand-type oxygen regulator. The lowering of pressure within the nebulizer at the start of inspiration released from the demand valve a flow of oxygen that then passed through the nebulizer. The penicillin aerosol in this technic was thus formed only on inspiration and did not require the co-operation of the patient. We recently modified our technic by attaching an Ohio humidifier directly to the regulator. The humidifier may be filled with hot tap water, which seems to add to the comfort of the patient. We are making further studies to determine whether it diminishes the occurrence of local reactions in the mouth and lips.

The nebulizer may be suspended or attached to a clysis stand for patients too sick to hold it themselves. We have found, however, that the majority of patients can comfortably hold the apparatus during the fifteen or twenty minutes of treatment. It is also advisable to have the nurse add 0.25 or 0.5 cc. of physiologic saline solution at the end of the last daily treatment to clean out the nebulizer and to prevent further deposition of penicillin in the delicate horizontal and vertical rods of the apparatus.

*Obtainable from Vaponefrin Company, Upper Darby, Pennsylvania.

For patients who are unable to use the technic described above, the O.E.M. mask can be employed. The nebulizer can be introduced into the face piece of the mask, and the oxygen entrance closed off. Infants and small children can best be treated in enclosed plastocele hoods or in specifically constructed closed chambers, the basic nebulizer and oxygen flows described above being used.

The basic Vaponefrin nebulizer can also be attached to the tracheotomy tube whenever topical penicillin aerosol therapy is desired in tracheotomy cases. We have found this of particular value in 2 patients with acute laryngotracheobronchial edema characterized by marked cyanosis and inspiratory retraction. These patients were moribund at the beginning of therapy. In these patients, instead of using oxygen, we have employed a mixture of 75 per cent helium and 25 per cent oxygen, introducing this mixture directly through the nebulizer. This technic may prove to be of lifesaving value in patients with laryngotracheobronchial obstructive disease.

Barach and his associates[13] devised an apparatus for the introduction of penicillin aerosol into the nasal accessory sinuses following suction. We[25] employed this apparatus in a series of 24 patients with infective sinus disease and found it extremely efficient.

Prigal and Speer[26] recently described a method of aerosolizing penicillin by the use of steam in place of oxygen flows. This procedure may be of value in infants and children with infective croup, and the aerosol can be directed into the oxygen tent if humidification is particularly desirable.

Penicillin Blood Levels

Absorption of penicillin from the pulmonary tree into the blood stream was demonstrated by effective penicillin blood levels, which ranged from 0.015 to 0.225 units per cubic centimeter in one hundred and sixteen determinations (Fig. 1). Large doses resulted in higher levels than did smaller doses, and the levels after crystalline† penicillin were higher than those after corresponding amounts of amorphous penicillin. Generally higher blood levels were obtained in patients with extensive lung involvement of a pyogenic type — that is, with pneumonia or lung abscess. Peak levels, which were observed at the end of thirty minutes, in some cases persisted for as long as two hours. The absorption of penicillin into the blood stream is not necessarily a measure of the topical effectiveness of penicillin aerosol. The blood levels vary according to the individual breathing pattern, equipment, dosage and type of penicillin, absorption variations of accumulated pus and secretions and the technic employed in the determination. In most of the cases the determination of blood levels is more of academic interest than of practical value. The clinical course is sufficient proof of the topical effectiveness of peni-

†Kindly supplied by Commercial Solvents Corporation, New York City.

cillin aerosol and is best demonstrated in patients with pneumonia.

It was considered advisable to study the penicillin blood levels* in a series of 6 normal medical students receiving penicillin aerosol by the pulmonary route (Table 1). Inhalations of 50,000 units of sodium penicillin in 1.0 cc. of physiologic saline solution were given with the technic described above. Blood levels were obtained thirty minutes, one hour and two hours after the beginning of each treatment. Similar studies were later performed on the same group,

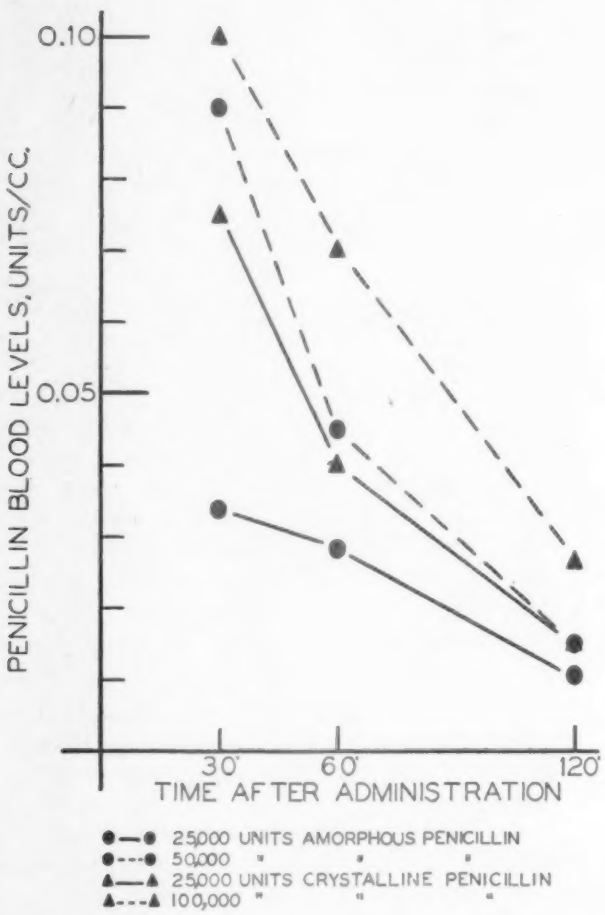

FIGURE 1. *Average Penicillin Blood Levels following the Inhalation of Penicillin Aerosol.*

1.0 cc. of 1 per cent Neosynephrine being substituted for the saline solution. The average figures obtained with penicillin-Neosynephrine aerosol appeared lower than those obtained with penicillin-saline aerosol, particularly after thirty minutes and one hour. This may be interpreted as indicating that Neosynephrine delays the absorption of penicillin through the pulmonary tree. In vitro studies have demonstrated that penicillin fully retains its potency in solutions of Neosynephrine for as long as twenty-four hours.[27] We are repeating these studies, employing 100,000 units in the same subjects, since a therapeutic agent that could achieve greater topical efficacy and less systemic effect would prove of considerable value in combating chronic pulmonary disease.

*This work was aided by a grant from Frederick Stearns and Company.

PNEUMONIA

Observations in this group of patients definitely proved the efficacy of penicillin aerosol in combating bacterial pneumonia and may serve as the rationale for its subsequent use in suppurative pulmonary disease. Clinical cures were obtained in 9 patients with pneumococcal pneumonia and in 1 with an acute pulmonary infarct and pneumonitis. The case histories and clinical charts of 6 of these patients were presented in an earlier report.[23] Blood levels of from 0.028 to 0.055 units per cubic centimeter were observed in 7 cases in which 25,000 units of penicillin had been administered. Levels as high as 0.250 units per cubic centimeter were obtained when 50,000 units were employed in 2 other patients. We do not advocate penicillin aerosol for the routine therapy of patients with pneumococcal pneumonia; the simpler procedures employing the sulfonamides or penicillin are preferable. For the management of pneumonia due to streptococcal, staphylococcal and penicillin-susceptible strains of Friedländer's bacillus, penicillin aerosol therapy is probably more effective than parenteral therapy alone. Combined aerosol and intramuscular therapy may be employed in patients who are seriously ill, particularly those with septicemia.

For patients with staphylococcal pneumonia the therapy should be continued for at least a week after all the clinical and roentgenographic signs of infection have subsided. Since the lesions tend to become fibrosed and walled off, protracted therapy

TABLE 1. *Penicillin Blood Levels in Control Subjects following the Inhalation of 50,000 Units.*

SUBJECT	SOLVENT	PENICILLIN BLOOD LEVEL		
		30 MIN. AFTER TREATMENT	1 HR. AFTER TREATMENT	2 HR. AFTER TREATMENT
		units/cc.	*units/cc.*	*units/cc.*
1	Physiologic saline solution	0.078	0.039	0.019
	Neosynephrine	0.039	0.039	0.019
2	Physiologic saline solution	0.078	0.039	<0.019
	Neosynephrine	0.078	<0.019	<0.019
3	Physiologic saline solution	0.078	0.078	0.039
	Neosynephrine	<0.019	0.019	<0.019
4	Physiologic saline solution	<0.019	<0.019	<0.019
	Neosynephrine	0.078	0.039	<0.019
5	Physiologic saline solution	<0.019	<0.019	<0.019
	Neosynephrine	0.039	0.019	<0.019
6	Physiologic saline solution	0.039	0.039	0.019
	Neosynephrine	0.039	0.039	<0.019
Average	Physiologic saline solution	0.052	0.039	0.019
	Neosynephrine	0.048	0.029	<0.019

is advisable to ensure complete eradication and to prevent exacerbations and abscess formations. To control pneumonia due to penicillin-susceptible strains of Friedländer's bacillus we have employed massive doses of 100,000 units at three-hour intervals in 2 cases. In one of these patients a blood level of 0.250 units of penicillin per cubic centimeter was obtained thirty minutes after the inhalation of 100,000 units. In both cases the organisms rapidly disappeared, remaining absent in one case during the course of therapy; in the other, however, the organisms recurred, although the patient remained symptom free for some time after the discontinuance of therapy. The patients with pneumococcal pneumonia required treatment for three to seven days. All were cured, with no ensuing complications, and they were generally discharged between the sixth and the eighth day after hospitalization. A brief abstract of a recently treated case of pneumonia follows:

A 28-year-old man entered the hospital with a complaint of pain in the right side of the chest of 4 days' duration. Two weeks prior to entry he had complained of a cough, productive of white frothy sputum. Examination revealed an acutely ill man. The temperature was 102°F. X-ray examination of the chest disclosed a typical pneumonia in the right upper lobe. Sputum culture revealed a Type 2 pneumococcus.

On admission a course of penicillin aerosol was started as follows: 50,000 units every 2 hours for six doses followed by 50,000 units every 3 hours until a total of 1,000,000 units had been given and, finally, 25,000 units every 3 hours, omitting the 3:00 a.m. dose daily. The temperature dropped to normal within 48 hours and remained essentially normal thereafter. A total of 2,115,000 units of penicillin was given over a 9-day period. Recovery was complete, and the clinical chart was similar to that in other cases previously reported.

Infective Bronchial Asthma

A course of penicillin aerosol lasting from three days to three weeks was given to 22 patients with severe chronic infective bronchial asthma. The penicillin-susceptible organisms promptly disappeared and in most cases remained absent during hospitalization. This therapy was generally disappointing, although striking improvement was occasionally observed. In these patients control of the primary bronchial infection with intramuscular penicillin and oral sulfonamides has proved equally disappointing. Most of the patients observed, however, that they were able to raise sputum more easily while receiving penicillin aerosol. Many objected to the taste and the irritating qualities of the aerosol. The danger of local or generalized allergic reaction to penicillin aerosol in asthmatic patients must always be kept in mind. Most of the local and urticarial reactions observed occurred in patients with bronchial asthma or bronchiectasis.

A striking remission was observed in a patient with chronic intractable bronchial asthma who was treated in the Barach rebreathing hood apparatus with mixtures of 75 per cent helium and 25 per cent oxygen under positive pressure. In addition, penicillin aerosol was introduced directly into the hood apparatus. Marked clinical improvement occurred after several days of such therapy. It was difficult, however, to evaluate the specificity of penicillin aerosol therapy in this case, for similar observations have been made in many patients treated with helium and oxygen under positive pressure without penicillin aerosol.[28, 29]

Bronchiectasis

A series of 30 patients with chronic bronchiectasis were treated with penicillin aerosol. Most of these patients received an initial course of therapy of at least six weeks and subsequently returned for an additional seven to ten days of therapy at intervals of three to six months. Postural drainage was carried out immediately before each treatment. Several of these patients continued to take penicillin aerosol therapy once daily at home throughout this period; this procedure was effective in preparing the patient for surgery and in preventing postoperative infections. Defervescence, lessening of toxicity, diminution in the amount of daily sputum, loss of its foul character, rapid disappearance of the penicillin-susceptible organisms, improvement in the patient's appetite and gain in weight were uniformly observed. Considerable improvement occurred in the bronchograms of several patients with involvement of a single lobe. This therapy was most helpful in the control and prevention of pneumonitis, which recurs in many patients with bronchiectasis. It was also of value in patients who were considered to be unsuitable for lobectomy or pneumonectomy or who refused to undergo such procedures. We are ever mindful that the anatomic changes accompanying bronchiectasis are permanent and cannot be altered by any type of therapy except resection. These patients are subject to repeated episodes of infection, pneumonitis or involvement of other lobes. The mucosal secretions in bronchiectasis largely result from the structural changes in the endothelial lining of the smaller bronchioles. Invasive organisms contribute by further destruction of the bronchioles. Infection can be eradicated or eliminated by penicillin aerosol, which thus provides the ideal therapy for preoperative and postoperative cases.

Many patients had previously received courses of intramuscular penicillin and oral sulfonamides without the striking effects obtained from penicillin aerosol, which effected longer periods of freedom from symptoms and recurrence of pneumonitis than other forms of therapy. The vital capacities of most of these patients increased from 30 to 40 per cent above the levels before aerosol therapy and remained fairly constant at the improved figure. Penicillin aerosol treatment can easily be carried out in the patient's home under supervision.

The penicillin-susceptible organisms uniformly disappeared from the sputum under such therapy. The appearance of gram-negative organisms, however, was observed in many patients who had been

refractive to penicillin aerosol. A recent report by Olsen[18] favored the use of streptomycin aerosol in such patients. He employed doses of 500,000 units a day by nebulization and reported negligible urine and blood levels. The streptomycin-susceptible organisms were uniformly eradicated, and favorable results were obtained in most cases. Our experience with streptomycin aerosol has been limited to 2 patients with Friedländer organisms. In our first trial with this drug the streptomycin-susceptible organisms rapidly disappeared when 100,000 units at three-hour intervals were employed but returned after several days of therapy. We then found it necessary to increase the dose. After a while the organisms became more resistive and could not be eradicated despite tremendous doses. The possible appearance of streptomycin-resistive strains with aerosol should be taken into consideration before such treatment is initiated. Barach has also called my attention to one of his patients who developed involvement of the eighth nerve, with ataxia, following the use of parenteral streptomycin therapy. It appears from the literature that streptomycin may prove of value in selected cases of pulmonary infection due to Friedländer, influenza or tubercle bacilli and that combined intramuscular and aerosol therapy may be efficacious in such cases. The practical usefulness of the drug, however, may be limited by its toxicity, the development of resistive strains and its cost.

A group of patients with sinus involvement either preceding or associated with bronchiectasis required special attention.[25] A number of these patients were treated with penicillin aerosol by the nasal route, suction being employed before the positive-pressure aerosol. The suppurative sinus disease was adequately controlled in most of these cases. The combination of sinusitis and bronchiectasis was found most difficult to treat adequately. The percentage of recurrences of active sinusitis and bronchiectasis has been higher in this group than in patients with uncomplicated bronchiectasis. Proper drainage and pressure therapy are important adjuncts to penicillin aerosol therapy by the nasal route in the management of acute and chronic purulent sinus disease. We consider this approach most valuable in the management of sinus disease and are indebted to Barach and his associates[13] for the development of the proper equipment.

A brief abstract of a recently treated case follows:

A 45-year-old woman entered the hospital complaining of a productive cough, fever and malaise of 1 month's duration. During the previous 7 years she had had frequent bouts of fever, chilliness, chest pain and a productive cough, lasting for several weeks at a time. Between attacks she had remained well. Three years previously a diagnosis of bronchiectasis of the lower lobe of the left lung had been made by a lipiodol bronchogram. During each of the recent bouts a course of sulfonamides had been given, with good results. After several days of such therapy the infectious process (pneumonitis) usually subsided rapidly and recovery was fairly complete in 1 to 3 weeks.

The present illness started as usual with a "head cold" and was characterized by fever, cough and malaise. Despite the usual course of sulfonamides the sputum increased in amount to about 150 cc. daily. Cultures revealed hemolytic streptococci and staphylococci. Physical examination and x-ray films revealed an atelectasis of the left lower lobe, with slight retraction of the heart to the left. A course of penicillin aerosol, 25,000 units every 3 hours for six daily doses, was started. Improvement quickly followed. The cough and sputum subsided after the 5th day of treatment. The organisms were no longer found in the sputum. The patient was greatly improved and as well as usual after 10 days of treatment.

Because of the persisting atelectasis, bronchoscopy was performed on the 11th day. The bronchi were patent throughout, and no secretions were found in the left lower lobe. Lipiodol was instilled, and the bronchogram revealed a minimal saccular bronchiectasis of the left lower lobe and a portion of the lingula; the entire lower lobe was considerably smaller than usual. Penicillin aerosol was continued for 3 days after this procedure, and the patient was then discharged and the therapy continued at home for a full 6 weeks' course. She had remained symptom free 3 months* following discharge.

Lung Abscess

We have employed penicillin aerosol therapy in a series of 11 patients with lung abscesses. Our observations have impressed us with its value in the aerobic, nonodoriferous, postpneumonic type of lung abscess; the results with the anaerobic, putrid, atelectatic types were disappointing. Doses of 50,000 units of penicillin given at three-hour intervals were usually adequate. Postural drainage was generally carried out prior to each treatment. In the more toxic and putrid cases we employed simultaneously 25,000 units of penicillin intramuscularly. Therapy was continued for at least four weeks. With an effective program of penicillin aerosol it is possible to avoid surgery in most of these cases. In most of our cases we did not employ intramuscular penicillin along with penicillin aerosol. Clinical and roentgenologic confirmation of cure was obtained in all cases; in several cure was further confirmed by lipiodol bronchograms. A brief abstract of a typical case follows:

A 37-year-old Negro entered the hospital complaining of high fever, shaking chills and hemoptysis. Two weeks before admission he had developed a nonproductive cough, chills, fever and pleuritic pain in the left side of the chest. The cough became productive of rusty sputum, later turned bloody and finally became rusty again, with a foul odor. The patient collapsed on the 15th day of the illness and was admitted to the hospital. He filled a box with putrid sputum during the first 12 hours in the hospital. The sputum smear revealed gram-positive and gram-negative diplococci, spirilla and fusiform bacilli. An x-ray film of the chest disclosed a pulmonary abscess opposite the left hilus.

A course of penicillin aerosol was started as follows: 50,000 units every 2 hours for six doses and subsequently every 3 hours until a total of 1,000,000 units had been given, after which the dose was reduced to 25,000 units every 3 hours, omitting the 3:00 a.m. dose. Postural drainage was carried out preceding each treatment. The temperature dropped rapidly to normal. The sputum rapidly lost its foul odor, and cultures subsequently revealed *Proteus vulgaris* and also *Klebsiella pneumoniae*. The patient was permitted up and about after the 4th week.

At the end of the 5th week of continuous therapy, a shortage of penicillin occurred, and inhalations of 1 cc. of 5 per cent sodium sulfathiazole at intervals of 3 hours were substituted for a 10-day period. A bronchogram revealed a small cavity, measuring 1.5 by 1.0 cm., presumably in the lingula. Penicillin

*Now 10 months following discharge, the patient is still symptom free.

aerosol was then resumed for 10 days, at the end of which a chest film revealed no evidence of the cavity and only slight residua of the lipiodol. The patient was then discharged symptom free.

Acute Laryngotracheobronchial Edema

Six patients with laryngotracheobronchial edema associated with serious infection were treated with penicillin aerosol, constant streams of oxygen or mixtures of 75 per cent helium and 25 per cent oxygen being employed. These patients were moribund at the outset of therapy. The conventional methods of employing sulfonamides, parenteral penicillin and oxygen therapy by catheter, mask and tent had been tried with little benefit. Dramatic improvement was observed as soon as the inhalation program was instituted. It was the opinion of many observers that the recovery of these patients could be directly attributed to the above therapy. A brief abstract of a recently treated case follows:

A 56-year-old man gave a history of aphagia and progressive inspiratory dyspnea of 14 hours' duration. He was found sitting up in bed struggling for breath, with marked inspiratory stridor and some prolonged expiratory wheezes through both lung fields. The temperature was 102°F. The lips were cyanotic, and the patient appeared critically ill. He had inhaled considerable dirt and dust while attempting to clean an attic. After several hours of exposure he began to cough, raising blood-streaked sputum, and noticed some shortness of breath. A few hours later he was found in a state of collapse. Oxygen and aminophyllin were administered, with little effect. Tracheotomy was being considered immediately before we first saw the patient. His wife stated that he had an extensive history of hay fever and seasonal bronchial asthma but had been free of asthma for several years and had complained of but minimal hay fever while undergoing hyposensitization injections. He had also shown marked positive reactions to molds and dust. An aural consultant had found extensive edema of the fauces and larynx.

Inhalation therapy, consisting of 75 per cent helium and 25 per cent oxygen through the O.E.M. positive-pressure mask, was instituted at once. At the same time 25,000 units of penicillin were introduced directly into the face piece with the Vaponefrin nebulizer. Treatments were given at 3-hour intervals. Inhalations of helium and oxygen mixtures with the mask set at 2.0 or 4.0 cm. of positive pressure were carried out for ½ hour out of each hour. Supplemental intramuscular aminophyllin was administered from time to time. Preceding each penicillin aerosol treatment, inhalation of 1.0 cc. Vaponefrin was introduced directly into the face piece. Improvement was striking from the beginning of therapy. The faucial and laryngeal edema subsided slowly and cleared entirely within 3 days; the respiratory stridor disappeared after 12 hours, the attacks of bronchospasm and coughing being easily controlled with the Vaponefrin inhalations, and the temperature returned to normal after the 2nd day. There were no complications, and recovery was complete on the 6th day of treatment.

Pulmonary Emphysema and Emphysematous Blebs

Patients with chronic pulmonary emphysema generally present a history of cough, progressive dyspnea even at rest, weight loss and weakness. Many develop severe clubbing of the fingers and cyanosis; in a few cases severe emphysematous blebs are present. Bronchiectasis and evidence of bronchospasm may also be found in many cases. The patients are subject to recurrent bouts of respiratory infections, and their pulmonary reserve diminishes with each bout. The prognosis is generally poor, and progressive respiratory failure develops. The patient can be made more comfortable with the use of 50 per cent concentrations of oxygen, aminophyllin and aerosolized bronchodilator drugs. Supplemental elevation of the diaphragms by manual manipulation in expiration and the use of a proper abdominal belt may be of considerable value. Oral sulfonamides have proved of little benefit in the prevention of recurrent infection.

We have recently observed striking improvement in a series of 6 patients with severe pulmonary emphysema when penicillin aerosol was added to the program described above. In one of these patients diffuse emphysematous blebs and a minimal basal bronchiectasis complicated the picture. In another a giant acquired cyst occupied the entire upper lobe of the right lung. The remaining 4 patients had uncomplicated pulmonary emphysema secondary to recurrent bronchial infections. These patients were considerably improved after a course of penicillin aerosol therapy of from one to six weeks. They had been treated with oxygen and bronchodilator drugs first but had developed more progressive dyspnea, cyanosis and cough. After penicillin aerosol administration the vital capacities improved slightly, and this improvement was maintained at home while the therapy outlined above was being continued. These remissions have been striking, although probably temporary.

We believe that all patients with severe pulmonary emphysema who fail to improve with treatment employing the principles discussed above should receive a course of penicillin aerosol therapy. A typical case history follows:

A 72-year-old physician complained of progressive cough and dyspnea of 6 years' duration. During the previous year the cough had been productive of 120 or 150 cc. of whitish, mucoid sputum daily. He had received two intensive courses of intramuscular penicillin and a course of oral sulfonamides without clinical improvement. Examination of the lungs revealed diminished breath sounds, coarse moist rales at the bases and marked hyper-resonance throughout. A chest plate revealed severe pulmonary emphysema, blebs and minimal basal bronchiectasis. The vital capacity was 1800 cc. The patient was advised to restrict his activities, to wear an abdominal belt and to take Adnefrin capsules and inhalations of Vaponefrin. On this program he improved remarkably and was soon able to resume most of his activities.

He continued these activities without many complaints for 10 months, when he acquired an upper respiratory infection and the earlier symptoms returned. The dyspnea soon became severe, and cyanosis appeared for the first time. The amount of sputum increased to about 300 cc. daily and cultures revealed many alpha-hemolytic streptococci and *Aerobacter aerogenes*. The cough was harsh and paroxysmal. During these paroxysms the cyanosis became marked, and the respiratory rate rose to 30 to 40. The patient was acutely ill on admission.

A program of inhalation therapy was instituted as follows: intermittent use of the oxygen tent and oxygen sprays of Vaponefrin at 3-hour intervals, followed by 25,000 units of penicillin aerosol for six daily doses. The clinical course was stormy during the first 2 days. Paroxysms of coughing and obstructive breathing frequently occurred, and on several occasions death from suffocation appeared imminent. Gradually, the cough became less severe and productive of thinner mucoid material. The respirations and pulse fell progressively to the high normal ranges. The pathogenic organisms disappeared from the sputum. At the end of 8 days of treat-

ment the patient was transferred to his home, where the therapy was continued. Approximately 3 weeks after admission to the hospital he was up and about, feeling comparatively well. The cough was hardly noticeable and productive of but 15 or 20 cc. of sputum daily. The vital capacity was 2400 cc. This improvement was maintained for several months. We believe, however, that this recovery is probably temporary, in view of the serious underlying pulmonary disease.

Discussion

Penicillin aerosol therapy is of definite value in the management of serious respiratory disease. It can be carried out best with the simple rebreathing technic described above. This may be modified, depending on the age of the patient and the nature of the illness. Helium and oxygen streams may be employed instead of oxygen for patients demonstrating obstructive respiratory disease. The penicillin aerosol may also be directed into tents, masks and tracheotomy openings. Other chemotherapeutic, antibiotic and chemical drugs may be substituted for penicillin if indicated. Finally, the penicillin aerosol may be directed nasally for the management of patients with acute and chronic purulent sinus disease.

Penicillin aerosol therapy should not be employed by the nasal or pulmonary route for the management of the common cold. This infection generally runs a self-limited course despite all so-called "useful therapy." One must always bear in mind the possibility of the appearance of penicillin-resistive strains in all cases of repeated or prolonged penicillin aerosol therapy.

This treatment should be reserved largely for patients with the following conditions: purulent sinusitis, bronchiectasis, lung abscess, infective bronchial asthma, infective bronchitis, pulmonary infections with the streptococcus, staphylococcus or penicillin-susceptible strains of Friedländer's bacillus and infections secondary to underlying primary disease of the lungs, such as pulmonary emphysema, lung cysts and infarcts. Every attempt should be made to identify the organisms from the nose, throat and sputum before therapy is begun.

Summary

Observations in the management, with penicillin aerosol, of 85 carefully studied patients with bacterial pneumonia, infective bronchitis, infective bronchial asthma, lung abscess, bronchiectasis, infective laryngotracheobronchial edema, pulmonary emphysema and pulmonary blebs are presented. Many of the patients were helped considerably, and some dramatically.

Penicillin blood levels were determined at intervals of thirty minutes, one hour and two hours after treatment, and one hundred and sixteen such determinations were charted. Peak levels were observed at the end of thirty minutes and in some cases persisted for as long as two hours. Generally, the higher peak levels were observed with the higher doses and occasionally in the patients with suppurative processes, such as pneumonia and lung abscess.

Streptomycin aerosol was also employed in 2 cases of bronchiectasis due to Friedländer organisms, but streptomycin-resistive strains rapidly appeared and could not be eradicated despite tremendous doses. This phenomenon was not observed in the penicillin-aerosol-treated cases. Penicillin may be safely combined with streptomycin aerosol when indicated. Further studies employing streptomycin aerosol, perhaps combined with intramuscular therapy, may prove of value in the management of selected cases of laryngeal and pulmonary tuberculosis.

References

1. Segal, M. S. Inhalation therapy in treatment of serious respiratory disease. *New Eng. J. Med.* **229**:235-241, 1943. Inhalation therapy. *Ibid.* **230**:456-465 and 485-493, 1944.
2. Richards, D. W., Jr., Barach, A. L., and Cromwell, H. A. Use of vaporized bronchodilator solution in asthma and emphysema: continuous inhalation method for severe asthmatic states. *Am. J. M. Sc.* **199**:225-232, 1940.
3. Barach, A. L. Physiologically directed therapy in pneumonia. *Ann. Int. Med.* **17**:812-819, 1942.
4. Castex, M. R., Capdehourat, E. L., and Pedace, E. A. Inhalation de substancios nebuli a cedos: comprobacion experimental de su poder de penetracion a nival del aparato respiratono. *Arch. argent. de enferm. d. ap. resp. y tuberc.* **9**:1, 1934.
5. Castex, M. R., Capdehourat, E. L., and Laverello, A. Nuevo tratamiento de las supuraciones broncopulmonares: acción curativa de un preparado sulfamidico nebulizado. *Rev. Assoc. méd. argent.* **55**:85-89, 1941.
6. Krueger, A. P., et al. Prophylaxis and treatment of experimental influenza by inhalation of immune serum. *Federation Proc.* **2**:101, 1943.
7. *Idem.* Inhalatory route for prophylaxis and treatment of experimental influenza: I. Distribution of inhaled material. II. Immune serum in prophylaxis and treatment. *Am. J. M. Sc.* **207**:40-60, 1944.
8. Mutch, N. Inhalation of chemotherapeutic substances. *Lancet* **2**: 775-780, 1944.
9. Bryson, V., Sansome, E., and Laskin, S. Aerosolization of penicillin solutions. *Science* **100**:33-35, 1944.
10. Barach, A. L., Oppenheimer, E. T., and Forman, J. Inhalation of penicillin in broncho-pulmonary infection. *News Letter, AAF Rheumatic Fever Control Program* **2**:10-21, 1945.
11. Barach, A. L., Silberstein, F. H., Oppenheimer, E. T., Hunter, T. H., and Soroka, M. Inhalation of penicillin aerosol in patients with bronchial asthma, chronic bronchitis, bronchiectasis and lung abscess: preliminary report. *Ann. Int. Med.* **22**:485-509, 1945.
12. Eckman, M., Rumsey, C. C., Jr., Barach, B., and Barach, A. L. Demand apparatus for automatic delivery of aerosols during inspiration. *J. Lab. & Clin. Med.* **30**:608-610, 1945.
13. Barach, A. L., Garthwaite, B., Soroka, M., and Anderson, F. F. Apparatus for introduction of penicillin aerosol into nasal accessory sinuses with case report of patient with chronic sinusitis. *Ann. Int. Med.* **24**:97-103, 1946.
14. Barach, A. L. Apparatus for inhalation of penicillin aerosol. *Mod. Hosp.* (in press).
15. Mutch, N., and Rewell, R. E. Penicillin by inhalation. *Lancet* **1**: 650-652, 1945.
16. Knott, F. A., and Clark, W. H. Absorption of aerosol penicillin via lungs. *Lancet* **1**:468, 1945.
17. Olsen, A. M. Nebulized penicillin: preliminary report of its role in management of surgical bronchiectasis. *Proc. Staff Meet., Mayo Clin.* **20**:184-194, 1945.
18. *Idem.* Streptomycin in treatment of chronic bronchiectasis: preliminary report. *Proc. Staff Meet., Mayo Clin.* **21**:53, 1946.
19. Hagens, E. W., Karp, M., and Farmer, C. J. Inhalation method for penicillin therapy: preliminary report. *Arch. Otolaryng.* **41**: 333-336, 1945.
20. Vermilye, H. N. Aerosol penicillin in general practice. *J. A. M. A.* **129**:250-257, 1945.
21. Hanks, R. J. Nebulized penicillin in treatment of respiratory infections. *Texas State J. Med.* **41**:253, 1945.
22. Segal, M. S., and Ryder, C. M. Penicillin aerosol in management of lobar pneumonia, bronchiectasis, lung abscess and infective bronchial asthma. *Bull. New Eng. M. Center* **7**:279-286, 1945.
23. *Idem.* Penicillin aerosolization in treatment of serious respiratory infections: preliminary report. *New Eng. J. Med.* **233**:747-756, 1945.
24. Segal, M. S. Progress in inhalation therapy. *Mod. Med.* **14**:63-79, 1946.
25. Miller, D., and Segal, M. S. Unpublished data.
26. Prigal, S. J., and Speer, F. D. New method of aerosolization of penicillin, sulfonamides and other medications for inhalation therapy: preliminary report. *Bull. New York. M. Coll., Flower & Fifth Av. Hosps.* **8**:21-25, 1945.
27. Burbidge, E. L. Personal communication.
28. Segal, M. S. Inhalation therapy in treatment of serious respiratory disease. *New Eng. J. Med.* **229**:235-241, 1943.
29. *Idem.* Advances in inhalation therapy, with particular reference to cardiorespiratory disease. *New Eng. J. Med.* **231**:553-556, 1944.

MEDICAL PROGRESS

ABDOMINAL SURGERY

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DURING the past year many articles have appeared on the management of battle wounds of the abdominal viscera. It is not possible to do this subject justice in a general review of abdominal surgery. Doubtless, this valuable experience with abdominal wounds will be collected in a separate report and will become an authoritative contribution. Suffice it to say that the selection of well trained, up-to-date surgeons, guided by consultants experienced in teaching and practice, played an important part in the remarkably fine results obtained.

EARLY AMBULATION

Early ambulation is discussed by Blodgett and Beattie.[1] These authors made a comparative study of 238 consecutive patients with abdominal operations treated by early rising and 443 similar patients who were kept in bed seven or more days after operation. In both groups complications were expected. They followed closely the principles of early ambulation set down by Leithauser and Bergo.[2] First, the patient is turned on the side of the operative wound, and the knees are flexed. He is then assisted to a sitting position on the side of the bed, and the shoes are put on. He is helped to stand on a footstool and encouraged to take deep breaths and to cough. He is walked for 8 to 10 feet and allowed to sit in a chair for ten minutes, after which he is walked back to bed. This process is repeated twice daily until the patient can arise and walk unaided. The early risers had less pain in their wounds, were able to care for themselves on about the fourth postoperative day and were ready for discharge from the hospital much earlier than the patients in the control group. There were fewer cases of wound disruption and fewer pulmonary complications with early ambulation, but there was a somewhat greater incidence of thrombosis in the leg veins.

It is essential to point out that early ambulation is often not well understood by the nursing personnel and by the house staff. Patients are lifted to a chair and allowed to sit too long, which, in fact, is conducive to stasis in the leg veins. The omission of the putting on of the shoes before walking is a serious matter, since the abnormal strain on the calf muscles may produce soreness that can be misinterpreted as early venous thrombosis. The added burden of carrying out these maneuvers correctly is compensated for by the early resumption of self-care. That modern preparation, anesthesia, wound closure and fluid replacement make early ambulation safe and sensible is accepted. The beneficial results obtained with shorter periods of postoperative recovery, less nursing care and probably fewer complications are well worth while.

HERNIA

Haber[3] suggests the use of a long, silk, guide suture, placed in healthy bowel just above the questionable segment in strangulated hernia. The loop in doubt is returned to the peritoneal cavity, and oxygen administered by mask for fifteen minutes. By gentle traction on the guide suture, the bowel is brought back into the wound for inspection. In 4 cases reported, the decision of viability was determined by this method. Doubtless, the circulation will have a better chance for restoration in its normal environment than by the usual technic of warm physiologic saline compresses on the exteriorized segment.

Fisher[4] reports 6 cases of interstitial hernia from McBurney appendectomy incisions that were diagnosed preoperatively as inguinal hernia. The herniation had taken place through the defect in the peritoneum of the wound, and the omentum had dissected along the muscle planes to the inguinal canal, presenting at the external ring.

In 1934 Wangensteen[5] reported the use of a large flap of fascia lata, turned cephalad and left attached at the upper end, for the repair of large inguinal and femoral defects. In a recent contribution he[6] reports the use of this technic in the repair of large abdominal-wall defects. In 3 cases of extensive carcinoma of the bowel and in 1 with a huge dermoid tumor in which large segments of the abdominal wall had been sacrificed, the use of these large pedicle grafts of fascia lata were used successfully. One of the defects measured 24 by 18 cm. In 3 patients with upper abdominal defects, one of which measured 26 by 21 cm., repair was achieved by swinging the lower rectus fascia upward.

THE SPLEEN

Dunphy[7] has made a timely contribution on the technic of splenectomy. He gives Balfour[8] credit for the method used. Instead of the tedious dissec-

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tion of the pedicle as the primary step in the procedure, the spleen is freed from its loose diaphragmatic and peritoneal attachments by gentle manipulation. It is then possible to deliver the organ into the wound and accurately to secure its vascular attachments easily and under vision from in front as well as behind. This shortens the time of operation, reduces the amount of blood loss and prevents accidental injuries to the tail of the pancreas and the fundus of the stomach. Although this method has long been used by many surgeons, it is probably not so well known as it should be.

Rives[9] added to knowledge in this field by describing a technic for simple delivery of the spleen when it was densely adherent from old inflammation. He suggested that by incision of the peritoneum above these attachments, the adherent peritoneum and the spleen could then be brought forward in the same manner used in the normally attached structure.

Babson and Morgan[10] have added to the literature the reports of 2 cases of spontaneous rupture of an apparently normal spleen. There have been reports of at least 8 additional cases since 1937. It is difficult to be sure that many of these patients had not received trauma, with probable rupture of the spleen, some time previously. The delayed or secondary hemorrhage in such cases, occurring days or even weeks after the original and often ignored injury, is well known.

Best and Schmid[11] cite 3 cases of rupture of malarial spleens unassociated with trauma, treated with early diagnosis and splenectomy with recovery. They call attention to the possible increase of this complication of malaria in veterans who served in the Pacific zones. Mild exertion, coughing, sneezing and straining at stool are frequent causative factors. If the condition is unrecognized and the patient is not operated on, the mortality is 100 per cent; the average reported death rate in such cases is 50 per cent.

Waugh[12] has collected 15 cases of peritoneal autotransplants of splenic tissue following rupture of the spleen — 9 by foreign and 6 by American writers. He reports in detail the case of a patient of his own who had been treated by splenectomy five years previously following an automobile accident. During laparotomy for hysterectomy, splenic implants the size of a pinhead to a pea were found scattered widely throughout the peritoneal cavity, particularly over the small bowel and cecum. Two of the implants were removed for microscopic confirmation.

Harmer and Chalmers[13] have collected 163 reported cases of splenic cysts. Hydatid cysts were twice as frequent as those of any other type. They distinguish between true and false cysts: the former are dermoid, epidermoid, hemangiomatous, lymphangiomatous and serous cysts, and the latter are large and single and at one of the splenic poles, with normal tissue elsewhere. They report in detail the case of a cyst in a twenty-four-year-old woman who had known she had a tumor mass for ten years. The specimen weighed 13 pounds and was 60 cm. in circumference.

Lazarus and Marks[14] give an excellent discussion of primary malignant tumors of the spleen, with a review of the literature. These tumors, which are rare, are divided into two groups — primary nonvascular sarcomas, arising from the endothelium of the splenic sinuses, and malignant angiomas. They are highly malignant and metastasize rapidly to the liver and less often to the lungs, the regional lymph nodes and the pancreas. The diagnosis may be suspected in a rapidly growing tumor that produces persistent pain, tenderness and cachexia. Early splenectomy is recommended.

Curtis and Movitz[15] have established the importance of accessory spleens. In 174 consecutive cases of splenectomy and in 4 of abdominal exploration, they found one hundred and thirty-one accessory spleens in 56 patients, an incidence of 32 per cent. The number of accessory spleens varied from one to ten — 26 patients had only one, and these were more frequent in the younger age group. The accessory spleens were located in the hilar region, the splenic pedicle, the retroperitoneal region near the tail of the pancreas, the great omentum, the colic ligamentary attachments, the mesentery of the small and large intestine and in the left adnexa in women. In all the multiple locations, there was always one spleen in the hilar region. This is explained on the basis of the embryologic development of the spleen. Curtis and Movitz point out the difference in true accessory spleens from a splenulus or splenosis often found in the abdominal cavity following ruptured spleens with hemorrhage. These authors attribute the failures, which generally occur following splenectomy for congenital hemolytic icterus and primary thrombocytopenic purpura, to the accessory spleens left in situ. They further warn against the danger of implants if the spleen is fragmented during its removal for these conditions.

Pugh[16] has made an excellent collective review of splenectomy, with a historical background of interest. He discusses the indications, mortality rates and technic of operation. He adds 15 case reports of his own, with 1 fatal case due to other injuries and not related to the removal of the spleen.

The Pancreas

Pancreatic heterotopia is discussed by Barbosa et al.[17] They review the literature and report 41 authenticated surgical cases, of which 25 were of clinical significance. The term "heterotopia" is applied to pancreatic tissue outside its usual or habitual location and without anatomic relation of continuity or of vascularization of the pancreas itself. These embryonic rests are seen so frequently during operations on the upper gastrointestinal

tract that it seems incredible that the authors found only 430 cases recorded in the literature. To be sure, the vast majority of the cases have no apparent clinical significance. Seventy per cent occur in the upper gastrointestinal tract. The duodenum, stomach and jejunum are involved in that order of frequency. The rests, however, are found in diverticulums of the stomach, duodenum and jejunum and in Meckel's diverticulum and also in the mesentery of the intestines, omentum, splenic capsule, gall bladder and bile ducts. Of the cases of clinical significance, 10 were in the stomach, 7 in the duodenum, 3 in the biliary tract and 2 in a Meckel's diverticulum. The largest, which was in the transverse mesocolon, measured 10.0 by 4.5 by 1.5 cm. and was cystic, containing stones. Symptoms are similar to that of ulcer with bleeding. Cancer occasionally occurs. Hypoglycemia from aberrant pancreas is reported. Barbosa et al. recommend removal of the rests when found and estimate that they will be observed once in each five hundred operations of the upper abdomen. It seems likely that this is a conservative estimate.

Acute pancreatitis occurring in previously cholecystectomized patients is discussed by Vuori,[18] who encountered 4 such patients whose cholecystectomy had been performed from one and a half to four years previously. Cholecystectomy during the acute attack of pancreatitis was performed on 4 patients, 2 of whom developed further attacks of pancreatitis. Of 23 patients treated conservatively, 7 had recurrent disease. Vuori considers cholecystectomy to have no great prophylactic value in the prevention of pancreatitis. It seems reasonably well established, however, that gall bladders containing stones should be removed after patients have recovered from acute pancreatitis.

Adams and Nishijima[19] present a new method of treating pancreatic cysts. In 2 cases the cysts were anastomosed to a jejunal loop with an enteroenterostomy. In 2 others a pancreatic fistula was implanted in the jejunum. Five patients responded well to the usual method of marsupialization and drainage. Anastomosis of these cysts to the intestinal tract may be the method of choice, particularly if one is careful to shunt the main intestinal stream through a bypass.

Sailer and Zinninger[20] report a case of a large islet-cell tumor without hypoglycemia in a forty-year-old woman with symptoms of duodenal ulcer. She was known to have had a mass in the epigastrium for two or three years. Exploration revealed a healed duodenal ulcer and a large nodular tumor involving the body and tail of the pancreas. Resection was done, and microscopic studies revealed an islet tumor of the delta-cell type, with local blood-vessel invasion. The patient received postoperative radiation but died of mesenteric thrombosis three years and ten months later. Autopsy revealed recurrence of the tumor in the remaining pancreatic tissue, liver, mesentery, bladder and uterus.

David and Campbell[21] bring the data concerning subtotal pancreatectomy for hypoglycemia up to date. They have collected the reports of 36 patients so treated, with 23 cases of recovery from hypoglycemia. Three of these were their own patients. Alloxan was ineffective in controlling the symptoms in all cases in which it was used. The authors believe that the reaction of human beings to this drug is different from that of experimental animals. It appears that the results justify subtotal pancreatectomy when a careful search fails to reveal an islet-cell tumor.

Whipple,[22] in his discussion of David and Campbell's paper, calls attention to the need for thorough mobilization of the duodenum to rule out tumor in the head of the pancreas. He had found the lesion in this location in 6 of 33 patients operated on. In 9 patients subjected to subtotal resection of the pancreas for hypoglycemia, the results were not good, and in 3 who were re-explored, the islet-cell tumor was found in the remaining head of the pancreas. Whipple further states that in some of the other 6 cases, he probably had not done a sufficiently radical subtotal resection. He remarks that total pancreatectomy is at times feasible and compatible with life.

An excellent review of radical surgery for lesions of the pancreas, as well as a detailed account of his personal experiences, is presented by Whipple.[23] He has performed the operation on 8 patients in two stages and on 21 patients in one stage. Earlier experiences with the two-stage approach with the increased difficulties from vascular adhesions at the second stage led him to advocate the one-stage procedure. He states that adequate preoperative administration of vitamin K makes this practicable. Attention is called to the value of the observation and special handling of anomalous extensions of the uncinate process around the superior mesenteric vessels. Whipple refers to Brunschwig's[24] monograph on pancreatic tumors as an important contribution to the subject.

Waugh and Clagett[25] report the experience of the Mayo Clinic in radical operation for cancer of the ampulla of Vater and the head of the pancreas. Thirty patients have been operated upon, 20 by these authors. They prefer a one-stage approach but believe that operation on some poor-risk patients should be done in two stages. The follow-up results were disappointing in carcinoma of the pancreatic head but encouraging in lesions of the ampulla. The operative mortality was 20 per cent.

Dennis and Varco,[26] in a collective review, found 104 cases of radical operation for carcinoma of the pancreas reported up to the time their paper was submitted for publication and added 13 new cases of their own. The total experience in the University of Minnesota hospitals at that time was with 46

cases of pancreatic cancer. Local excisions have been done in 9 cases, and radical operations in 14. In simple exploration the mortality was 23 per cent, and in radical extirpation, it was 29 per cent, whereas in local excision, it was 11 per cent. The authors consider most of the deaths to have been due to errors that are now avoidable. Like all surgeons experienced in this field, they prefer the one-stage operation, biliary-tract continuity from the common hepatic duct to the jejunum being established with implantation of the pancreatic duct. They believe that the gastrojejunostomy is best done about 40 cm. distal to the implantation of these structures. This is a matter of choice, and most surgeons regard a much higher anastomosis between the stomach segment and the jejunum as satisfactory.

The Biliary System

Clagett and Hawkins,[27] in an interesting case report, described the successful removal of the left lobe of the liver for multilocular cyst. A Bethune pneumonectomy tourniquet was used to control the base of the lobe during extirpation. Von Harborer is cited as having used a similar technic for the removal of a nonparasitic cyst in 1908. Such cysts in the liver are frequently associated with cystic disease of the kidneys. It is likely that many surgeons have had the opportunity to do this operation once or twice, but few reports have appeared in the literature.

Flynn[28] presents a timely discussion of the modern management of pyogenic liver abscess, with the successful treatment of 1 patient. He attributes his success to early diagnosis followed by adequate drainage and the use of penicillin. In the prechemotherapy era, the mortality for pyogenic liver abscess ranged from 50 to 95 per cent. In a recent case of an extremely large liver abscess of this type treated at the Massachusetts General Hospital, streptomycin was used following adequate drainage, with spectacularly quick sterilization of the abscess cavity.

Gatch, Battersby and Wakim[29] presented experimental evidence that cholecystitis is initiated by chemical action and that infection is due to the secondary invasion of bacteria on the chemically damaged gall-bladder wall. They produced acute inflammation in the gall bladders of dogs by introducing bile salts under pressure. Activated pancreatic juice caused acute edema and inflammation in the bile ducts of the animals when injected through the papilla of Vater. Stones in the gall bladder, with acute obstruction of the cystic duct, are believed to allow the imprisoned bile salts to damage the gall-bladder wall. Infection that follows depends on the degree of chemical action due to the duration of obstruction. Their deductions are as follows: early operation in acute cholecystitis is necessary only in fulminating cases; the gall bladder as a rule is not a focus of infection; prolonged drainage is not necessary; there is little danger from spreading infection if the acute gall bladder is opened during operation; and exploration of the common hepatic duct is dangerous in the presence of acute edema and should be reserved for a later procedure if it becomes necessary.

Glenn and Heuer[30] present the results obtained in the New York Hospital in the treatment of acute cholecystitis over a thirteen-year period. They advocate early operation, which they have performed on 527 patients. Of 175 patients over fifty years of age, 9 succumbed, whereas only 4 of 352 under the age of fifty died. The over-all mortality was 2.5 per cent. Cholecystectomy was performed in 460 cases, being combined with choledocostomy in 43. Of the 67 patients treated by cholecystostomy alone, 5 succumbed. These results are in close accord with those at the Massachusetts General Hospital. The older the patient, the greater the risk, and in our series drainage of the gall bladder also carried a higher mortality rate than cholecystectomy.[31]

Johnstone and Ostendorph[32] found 32 cases of perforation of the gall bladder in 12,000 consecutive cases at routine autopsy. One in every 375 persons in the group died of this complication. There were 22 men and 10 women in the series. General peritonitis was found in 42 per cent of cases; 47 per cent of the cases of perforation were undiagnosed before autopsy. The authors reported a series of 105 cases of acute gall-bladder disease treated surgically in which, as would be expected, the mortality was lower in patients operated on in the early days of the process.

Hicken and Coray[33] found spontaneous fistulas in some portion of the gastrointestinal tract in 4.2 per cent of their patients with biliary-tract disease. The fistulas were most frequently due to stone erosion, peptic ulcer and malignant disease ranking second and third as causes. Cholangiographic studies on the operating table are considered of great value in determining the extent and source of the fistula. Hicken and Coray advocate preventive measures by earlier treatment of gallstones and ulcer. Stage procedures are recommended, since the re-establishment of normal continuity of bile flow into the gastrointestinal tract leads to spontaneous closure of the fistula.

Goldman et al.[34] relieved 2 patients of residual common-duct stones with the introduction of Suby and Albright's solution G by means of Murphy drip through a T tube. They found, however, that this solution did not dissolve gallstones in a test tube. Since solution G is somewhat similar in composition to *U.S.P.* magnesium citrate solution, they concluded that the beneficial results were probably due to the relaxation of the muscle fibers of the papillary region by this drug.

Hudson and Johnson[35] report 4 cases of gastrointestinal hemorrhage from the gall bladder. In 1 a hemangioendothelial sarcoma of the gall bladder was

found. In the other 3 chronic infection and stones, in the presence of arteriosclerosis, were apparently responsible for the bleeding. It is properly suggested that the gall bladder should be considered a possible source of obscure anemia of gastrointestinal origin. In 1931 White and Jankelson[36] reported similar cases and discussed the differential diagnosis in hemorrhage of gall-bladder origin. It is possible that this phenomenon may be based on the associated duodenitis secondary to inflammation of the gall bladder.

Norgore[37] collected from the literature 31 cases of traumatic rupture of the gall bladder, to which he added a case of his own in which the patient was a thirty-seven-year-old man who had been injured in an automobile accident. Attention was paid to a fractured left fibula until a few hours later, when the patient complained of abdominal pain. Seventeen and a half hours after the accident, exploration revealed biliary peritonitis from a rent in the gall-bladder wall. The opening was closed, and cholecystostomy was performed, with uneventful recovery of the patient.

Extreme dilatation of the common hepatic ducts, with repeated operations for stones, sand and mud, are discussed by Sanders,[38] who has handled the problem in 22 cases by a generous lateral anastomosis between the enlarged duct and the duodenum, with satisfactory results. Usually, a wide dilation of the outlet of the duct, either by sharp incision or stretching, relieves this situation. Plastic operations from within the duodenum for this type of chronic dilatation with distal stenosis are described by Lahey.[39]

Experience with benign stricture of the common bile duct at the Mayo Clinic is reported by Flickinger et al.[40] There were 188 patients, with a history of surgical trauma in 73 per cent. Symptoms were present immediately after cholecystectomy in 58 per cent, and there was a recognized accident during operation in only 9 per cent. Eighteen patients developed symptoms of hepatic-duct stricture three to twelve years after operation. It is significant that 12 per cent of all patients had been subjected to cholecystectomy in the absence of gallstones. All but 2 had had previous biliary-tract surgery. The usual procedure was choledochoduodenostomy or hepaticoduodenostomy. There was a 12 per cent operative mortality, 18 per cent of patients dying after leaving the hospital; 31 per cent continued to have symptoms. The 188 patients had had a total of two hundred and seventy-eight operations before admission to the clinic, and in these cases a total of two hundred and eighteen reconstructive procedures were done. Thirty patients who continued to have symptoms after re-establishment of continuity were finally well; 36 per cent of all survivors were well at the last report.

This distressing complication of biliary-tract surgery was discussed by Pearse,[41,42] who made a collective review from correspondence with other surgeons and from his own experience on the use of vitallium tubes in reconstructive operations for benign strictures of the bile ducts. Approximately 80 per cent of the patients had a satisfactory result at the time of his report. This is a high figure, and many of these patients will subsequently need further surgery to relieve the recurring symptoms. The discussion of the propylactic measures concerning this problem is excellent. In only 1 patient out of 14 on whom the vitallium-tube method was used at the Massachusetts General Hospital was the final result apparently satisfactory. The duct in this patient had successfully been repaired over a vitallium tube used in the reconstruction two and a half years previously. When jaundice, pain, fever and chills brought the patient back to the hospital, the encrusted vitallium tube was acting as a large stone obstructing the outlet. Three other patients developed a new stricture — 2 above and 1 below the tube. The problem is serious, and repeated operations are often necessary before conditions are found that lend themselves to a suitable solution.

Peterson[43] has reported 42 cases of so-called "reformed gall bladder," most of which resulted from a remnant of the gall bladder at the ampulla. Some apparently developed from a long cystic duct. Peterson considers the term a misnomer and believes that the condition actually represents the results of an incomplete operation. Symptoms are comparable to those in patients whose gall bladders have not been removed. In many cases the common bile duct is not dilated, as normally takes place following cholecystectomy, and symptoms are due to the intact nerve mechanism, which produces repeated spasm of the sphincter of Oddi. Peterson discusses the great care needed in cholecystectomy, with the absolute identification of all structures. It is pertinent to state that an incomplete operation under certain conditions of acute inflammation with edema about the ducts is preferable to the serious sequelae that often follow cholecystectomy.

Guyton[44] gives a case report of double gall bladder in a forty-two-year-old woman. Both bladders contained stones and were joined by a single cystic duct.

McLaughlin[45] operated on a twenty-five-year-old Negro who had suffered a weight loss of 25 pounds because of discomfort and a feeling of fullness after eating. A large tumor was palpated in the right upper quadrant, and a nonfunctioning gall bladder was reported after study. A large cyst of the choledochus was aspirated of 1000 cc. of bile. This was dissected free from below upward, and all but a proximal remnant was removed. The remaining segment was anastomosed to the duodenum, with a good result.

Shallow et al.[46] collected from the literature 182 cases of congenital cystic dilatations of the common bile duct and reported 2 cases of their own. In the first patient, who was operated on in 1941,

excision of the dilated common duct was performed, with anastomosis of the two hepatic ducts separately into the duodenum. The second patient had an enormous abdominal tumor, from which 5800 cc. of dark-brown material containing bile and amylase was aspirated; an anastomosis was made between the cyst and the duodenum. Both patients were well and symptom free at the time of the report.

(To be concluded)

References

1. Blodgett, J. B., and Beattie, E. J. Early postoperative rising. *Surg., Gynec. & Obst.* **82**:485-489, 1946.
2. Leithauser, D. J., and Bergo, H. L. Early rising and ambulatory activity after operation: means of preventing complications. *Arch. Surg.* **42**:1086-1093, 1941.
3. Haber, J. J. Use of guide suture in strangulated hernia. *Am. J. Surg.* **71**:392-395, 1946.
4. Fisher, H. C. Postappendectomy interstitial inguinal hernia. *Ann. Surg.* **123**:419-426, 1946.
5. Wangensteen, O. H. Repair of recurrent and difficult hernias and other large defects of abdominal wall employing iliotibial tract of fascia lata as pedicled flap. *Surg., Gynec. & Obst.* **59**:766-780, 1934.
6. *Idem.* Repair of large abdominal defects by pedicled fascial flaps. *Surg., Gynec. & Obst.* **82**:144-150, 1946.
7. Dunphy, J. E. Splenectomy for trauma: practical points in surgical technic. *Am. J. Surg.* **71**:450-460, 1946.
8. Balfour, D. C. Technique of splenectomy. *Surg., Gynec. & Obst.* **23**: 1-6, 1916.
9. Rives, J. D. Splenectomy: method of mobilizing spleen in presence of dense adhesions. *Surgery* **11**:223-228, 1942.
10. Babson, W. W., and Morgan, P. Spontaneous rupture of apparently normal spleen. *Am. J. Surg.* **72**:97-102, 1946.
11. Best, R. R., and Schmid, J. F. Ruptures of malarial spleens unassociated with external trauma. *Surg., Gynec. & Obst.* **82**:731-734, 1946.
12. Waugh, R. L. Multiple peritoneal autotransplantation of splenic tissue following traumatic rupture of spleen. *New Eng. J. Med.* **234**:621-625, 1946.
13. Harmer, M., and Chalmers, J. A. Splenic cysts: with report of case. *Brit. M. J.* **1**:521-523, 1946.
14. Lazarus, J. A., and Marks, M. S. Primary malignant tumors of spleen: with special reference to endotheliomas. *Am. J. Surg.* **71**:479-490 1946.
15. Curtis, G. M., and Movitz, D. Surgical significance of accessory spleen. *Ann. Surg.* **123**:276-289, 1946.
16. Pugh, H. L. Splenectomy, with special reference to its historical background. *Internat. Abstr. Surg.* **83**:209-224, 1946.
17. Barbosa, J. J., de Castro, Dockerty, M. B., and Waugh, J. M. Pancreatic heterotopia: review of literature and report of 41 authenticated surgical cases of which 25 were clinically significant. *Surg., Gynec. & Obst.* **82**:527-542, 1946.
18. Vuori, E. E. Vier Fälle von akuter Pankreatitis bei vorher cholecystektomierten Patienten. Einiges über Rezidive in einem Material von 46 akuten Pankreatitisfällen. *Acta chir. Scandinav.* **88**:220-226, 1943.
19. Adams, R., and Nishijima, R. A. Surgical treatment of pancreatic cysts. *Surg., Gynec, & Obst.* **83**:181-187, 1946.
20. Sailer, S., and Zinninger, M. M. Massive islet cell tumor of pancreas without hypoglycemia. *Surg., Gynec. & Obst.* **82**:301-305, 1946.
21. David, V. C., and Campbell, L. K. Experiences in subtotal resection of pancreas in hypoglycemia. *Ann. Surg.* **123**:836-846, 1946.
22. Whipple, A. O. Discussion of David and Campbell.[21]
23. *Idem.* Observations on radical surgery for lesions of pancreas. *Surg., Gynec. & Obst.* **82**:623-631, 1946.
24. Brunschwig, A. *The Surgery of Pancreatic Tumors.* 421 pp. St. Louis: C. V. Mosby Company, 1942.
25. Waugh, J. M., and Clagett, O. T. Resection of duodenum and head of pancreas for carcinoma. *Surgery* **20**:224-232, 1946.
26. Dennis, C., and Varco, R. L. Neoplastic biliary obstruction. *Surgery* **20**:72-81, 1946.
27. Clagett, O. T., and Hawkins, W J. Cystic disease of liver. *Ann. Surg.* **123**:111-118, 1946.
28. Flynn, J. E. Pyogenic liver abscess: review of literature and report of case successfully treated by operation and penicillin. *New Eng. J. Med.* **234**:403-407, 1946.
29. Gatch, W. D., Battersby, J. S., and Wakim, K. G. Treatment of cholecystitis. *J. A. M. A.* **132**:119, 1946.
30. Glenn, F., and Heuer, G. J. Surgical treatment of acute cholecystitis. *Surg., Gynec. & Obst.* **83**:50-54, 1946.
31. Wallace, R. H., and Allen, A. W. Acute cholecystitis. *Arch. Surg.* **43**:762-772, 1941.
32. Johnstone, G. A., and Ostendorph, J. E. Cholecystitis with perforation. *Arch. Surg.* **53**:1-12, 1946.
33. Hicken, N. F., and Coray, Q. B. Spontaneous gastro-intestinal biliary fistulas. *Surg., Gynec. & Obst.* **82**:723-730, 1946.
34. Goldman, B., Jackman, J., and Eastman, R. H. Management of postoperative choledocholithiasis: another use for solution G. *Surg., Gynec. & Obst.* **81**:521-524, 1945.
35. Hudson, P. B., and Johnson, P. P. Hemorrhage from gall bladder. *New Eng. J. Med.* **234**:438-441, 1946.
36. White, F. W., and Jankelson, I. R. Gastro-intestinal hemorrhage in disease of gall bladder. *New Eng. J .Med.* **205**:793-797, 1931.
37. Norgore, M. Traumatic rupture of gall bladder: case reports and notes on choleperitoneum. *Ann. Surg.* **123**:127-134, 1946.
38. Sanders, R. L. Indications for and value of choledochoduodenostomy. *Ann. Surg.* **123**:847-858, 1946.
39. Lahey, F. H. Discussion of Sanders.[38]
40. Flickinger, F. M., and Masson, J. C. Reconstructive operations for benign stricture of bile ducts. *Surg. Gynec. & Obst.* **83**:24-36, 1946.
41. Pearse, H. Unpublished data.
42. *Idem.* Benign strictures of bile duct. *Surg., Gynec. & Obst.* **83**:549, 1946.
43. Peterson, F. R. Re-formed gall bladder: review of 42 cases. *J. Iowa State M. Soc.* **36**:134-138, 1946.
44. Guyton, W. L. Double gall bladder. *Am. J. Surg.* **72**:118-120, 1946.
45. McLaughlin, E. F. Choledochus cyst. *Ann. Surg.* **123**:1047-1062, 1946.
46. Shallow, T. A., Eger, S. A. and Wagner, F. B., Jr. Congenital cystic dilatation of common bile duct: follow-up on previously reported case and report of additional case. *Ann. Surg.* **123**:119-126, 1946.

CASE RECORDS OF THE MASSACHUSETTS GENERAL HOSPITAL

Weekly Clinicopathological Exercises

FOUNDED BY RICHARD C. CABOT

TRACY B. MALLORY, M.D., *Editor*

BENJAMIN CASTLEMAN, M.D., *Associate Editor*

EDITH E. PARRIS, *Assistant Editor*

CASE 33041

PRESENTATION OF CASE

A sixty-nine-year-old married farmer was admitted to the hospital because of a gradually developing stiffness and pain of the right knee.

The patient stated that in childhood he had received a severe laceration of the anteromedial aspect of the right knee causing immobilization for about two months. Seven years before entry he noted the gradual onset of pain and stiffness of the knee, as well as the appearance of a mass on the inner aspect. The stiffness and pain had grown worse, and the mass had gradually increased in size until two years before admission, when the increase had become more rapid. A cast was applied; baking, massage and manipulations of the neck and knee were without benefit. During the year before entry the pain became severe and constant and the mass grew larger; the patient continued to work, however.

Physical examination revealed a hard, fixed, tender mass on the posteromedial aspect of the right knee over the medial side of the joint and the condyle, extending posterolaterally in the popliteal space and proximally along the medial portion of the hamstring muscles. The mass was about the size and roughly the shape of two lemons, but with indefinite edges. The skin was freely movable over the tumor mass. The knee was in 120° flexion, with slight motion either active or passive. The leg was in adduction on the thigh. The right inguinal region was tender to deep palpation, but no large definite lymph nodes were felt.

The blood pressure was 184 systolic, 100 diastolic.

The routine laboratory data were normal. An x-ray film revealed slight decalcification of the bones of the right knee joint, which was otherwise normal. Posterior to the joint there was a soft-tissue mass, measuring 6.5 by 5 cm., that contained flecks of calcification (Fig. 1). The blood serum calcium was 9.2 mg., and the phosphorus 2.4 mg. per 100 cc.; the phosphatase was 5.6 Bodansky units.

An operation was performed on the thirteenth hospital day.

DIFFERENTIAL DIAGNOSIS

DR. MERRILL C. SOSMAN*: The x-ray films show a poorly defined mass that is best seen in the lateral view of the knee, on the film with the lighter exposure. The mass is made up of individual lobules, in some of which fine flecks of calcium are deposited. The mass extends beyond the upper end of the tibia and well up behind the femur, but there is no bone destruction. The joint looks quite normal in contour and width, and the mass is distinctly outlined in some sections, so that invasion of the soft tissues is not suggested. One of the first considerations with a mass anywhere in the body is to obtain a film of the chest. In the films in this case the lungs are clear of metastases. This looks discouragingly easy because the majority of firm nodular masses behind the knee, particularly if they contain small flecks of calcium, turn out to be synovial tumors. All of us, I am afraid, make the mistake of calling them "synoviomas." Do you call them "synoviomas" when you run across them?

DR. TRACY B. MALLORY: We use that term because it is a standard one. I have never been altogether convinced that it was correct, however.

DR. SOSMAN: Synovia, as I understand it, is the fluid in the knee joint. The synovial tissue, not the fluid, is the point of origin of the tumor, so that it is more accurately called "synovialoma." This was brought out by Jönsson† in an article based on 90 cases of malignant tumors of skeletal muscle, fascia, joint capsules and tendon sheaths, all of which had the same characteristics, irrespective of their point of origin. Histologically the tumors can be divided into the following eight groups: fibromyxosarcoma, endothelioma, spindle-cell sarcoma, hemangioblastoma malignum, angioblastic sarcoma, what Jönsson called "polymorphous-cell sarcoma" (which is new to me but was so called, I suppose, because it had so many kinds of cells), alveolar sarcoma and round-cell sarcoma. These tumors, however, might be classified under a group of synovialomas of the malignant type.

Since the x-ray films suggest a synovialoma, I fear a trap; that diagnosis seems too simple. Of the other tumors that occur in this situation, a Baker cyst is one of the most frequent. Do you agree to that Dr. Barr?

DR. JOSEPH S. BARR: I think that it is the most frequent tumor in the popliteal space.

DR. SOSMAN: The few I have seen were not so hard as this one was said to be, and none of them contained calcification. Have you seen calcification in a Baker cyst?

DR. BARR: No.

DR. SOSMAN: I therefore think that we can rule out a Baker cyst. The angiomas are usually softer

*Roentgenologist, Peter Bent Brigham Hospital.

†Jönsson, G. Malignant tumors of skeletal muscles, fasciae, joint capsules, tendon sheaths and bursae. *Acta Radiol.* **20**:105-127, 1939.

than the tumor in this case and usually contain phleboliths, particularly if they are venous angiomas. Lipomas usually show characteristic diminished density on x-ray examination when they are in or between the muscles and fascia, but they do not show the increased radiability if they are in the subcutaneous tissue, where they are surrounded by fat. Fibromas could conceivably originate from synovial tissue and therefore be regarded as synovial tumors.

DR. GRANTLEY W. TAYLOR: The knee was listened to, nothing abnormal being heard, and there were perfectly normal pulsations in the ankle vessels. There was no bruit or pulsations over the mass.

DR. SOSMAN: Arteriovenous aneurysms have either bruit or arterial pulsations or both in practically all cases.

I have not seen tuberculomas behind the knee, although they can occur anywhere. But the absence

FIGURE 1. *Roentgenogram of Right Knee.*

An aneurysm of the popliteal artery should be considered, and they contain calcium, particularly the arteriovenous aneurysm. These usually follow a penetrating wound, however, in which there has been an actual cutting of the artery and vein, resulting in arteriovenous communication, and produce channel-like structures. This case might possibly fit that description. In this situation that obsolete instrument, the stethoscope, might come into play. Was the stethoscope used on this knee?

of tuberculosis in the chest helps to rule out that diagnosis. Another possibility is a giant-cell tumor of the tendon sheath, which may occur anywhere but much more frequently around the wrist. It may be lobulated and may contain flecks of calcium.

In summary, I think that this was a mesoblastoma that arose not from endothelial or epithelial cells but from some of the mesoblastic structures. If I had not been invited to discuss this case I should have called it a synovialoma.

DR. MALLORY: Dr. Taylor, you saw this patient. Will you give your opinion?

DR. TAYLOR: When I saw this patient on the Orthopedic Service, my reasoning was much the same as that of Dr. Sosman. I examined the vessels in the ankle closely with the stethoscope. If Dr. Van Gorder had not gone out so flat-footedly for synovioma I should not have considered any other tumor with such enthusiasm.

DR. SOSMAN: Why did you think it was not synovialoma?

DR. TAYLOR: I thought that there was more calcification than there should be in a synovioma.

DR. SOSMAN: In Jönsson's article some of the illustrations reveal calcification in the tumor.

DR. TAYLOR: They do, but not so much as that in this case.

DR. SOSMAN: I agree with you that there is generally little or no calcification.

DR. TAYLOR: Do you think that the long duration argues against that type of tumor?

DR. SOSMAN: I do not believe so. Synovialomas may have a low degree of malignancy. This tumor was of six years' duration, with a sudden exacerbation of growth. Synovialomas may begin as benign or slowly malignant tumors.

DR. MALLORY: I am forced to disagree. In our experience, synoviomas have been among the most malignant tumors.

DR. SOSMAN: In young people they are quite malignant but not in old people. If the tumor had been present for ten years and had been extremely malignant metastases would certainly have occurred by the time of admission.

DR. TAYLOR: I agree with Dr. Mallory. I cannot imagine a malignant tumor that existed so long without dissemination, however.

DR. SOSMAN: Synovialomas are rare at this age.

DR. MALLORY: What does Dr. Lingley think about it?

DR. JAMES R. LINGLEY: The x-ray appearance is consistent with that of synovioma. But I agree that such a tumor is rare at the age of this patient. All the cases I have seen have occurred in young patients.

DR. SOSMAN: I should have mentioned a chondrosarcoma, which almost always arises on an osteochondroma and in which the original bony pedicle is visible somewhere around the joint. I do not remember a case in which chondrosarcoma arose from the joint cartilage itself. It must be considered because cartilage is one of the main structures of the joint. Cartilage is an end product, a secondary type of cell differentiation, and a tumor might start from embryonic or fibroblastic tissue and develop into cartilage. I should like to add chondrosarcoma to the mesothelial group, which could all be called synovialomas.

DR. MALLORY: Will you tell us the operative findings, Dr. Barr?

DR. BARR: I tried to steer a middle course between Dr. Van Gorder and Dr. Taylor in the diagnosis. I was not sure what the diagnosis was. I thought of all these things but did not commit myself beyond the fact that I considered this a tumor and not a Baker cyst. The exposure was made through a posterior incision. A hard mass was found about the size of a small orange or lemon, in exactly the situation where one would find a Baker cyst. It was somewhat lobular and irregular and of hard, rubbery consistence. It was excised and was found to communicate with the joint by a small pedicle. I had hoped that we could do an excision of the whole tumor, whatever it was, and therefore had not opened it for biopsy. The dissection planes opened freely and easily, exposing the whole tumor. When the joint at the base of the pedicle was opened, three small, free fragments of tumor came out of the joint. We noted at that time that we had not been successful in excising the tumor completely.

CLINICAL DIAGNOSIS

Malignant tumor of right knee.

DR. SOSMAN'S DIAGNOSIS

Synovialoma (mesoblastoma).

ANATOMICAL DIAGNOSIS

Chondroma of right knee.

PATHOLOGICAL DISCUSSION

DR. MALLORY: The specimen that was resected had the characteristic gross appearance of a chondroma. It was hard but also elastic, white and glistening. Histologically it consisted of well differentiated cartilage with a good deal of intercellular matrix and comparatively few cells. The appearance was completely benign from the histologic point of view. How a chondroma could arise in this spot, where there is normally no cartilage, is an interesting speculation. It may have been secondary to metaplastic cartilage formation. Occasionally, inside the knee joint, extensive change of the synovial tissue into cartilage occurs. The three tiny fragments within the knee joint slightly suggested that possibility. On the other hand it is difficult to understand how a process of that sort could have produced a large tumor external to the joint cavity. It is true that this man had had a lacerating injury of the knee in childhood and may have had a slightly deficient posterior capsule. I called it a chondroma and assumed that it must have arisen from a metaplastic process — a new formation of cartilage in the joint capsule. Cartilage can form from fibrous tissue in innumerable parts of the body and sometimes forms visibly peculiar areas.

DR. SOSMAN: There was no sign of invasion? Did the tumor shell out perfectly smoothly?

DR. BARR: Yes; just as smoothly as a Baker cyst.

DR. SOSMAN: Was it attached to the cartilage of the knee joint?

DR. BARR: No; just to the capsule itself. Was that true histologically?

DR. MALLORY: Yes.

DR. BARR: Were the lines of excision beyond the tumor itself so far as you could determine?

DR. MALLORY: Yes.

DR. JOSEPH C AUB: What is the function of the knee at present?

DR. BARR: It was markedly limited before the tumor was removed; the patient had practically no motion, obviously because the posterior tibial nerve lay directly over the tumor and on attempts at extension it was spread so that he could not extend the leg on account of the pain and could not flex it because of the tumor mass. He has gained some motion but has still far from normal function of the knee.

CASE 33042

PRESENTATION OF CASE

A sixty-six-year-old Greek textile worker entered the hospital because of anorexia and weight loss.

Eighteen years before entry the patient had had a six-day episode of abdominal swelling. Seven years later he had had a short period of illness associated with nausea. Four years before admission an attack of sharp epigastric pain had occurred. Two years later, following a tooth extraction, he developed chilly sensations and began to lose weight. X-ray studies were said to have shown gallstones, and fourteen months before entry a cholecystectomy was performed at another hospital. The gall bladder was chronically inflamed and thick walled, and contained several dark stones, the largest of which measured 1.2 cm. in diameter. The wound drained, and healing required five months, during which the patient developed jaundice and ran a slight fever. Six months before entry he was readmitted to the hospital because of jaundice, pain in the chest and epigastric region, and vomiting for three days. At that time examination of the blood showed a red-cell count of 3,440,000, with a hemoglobin of 62 per cent, and a white-cell count of 8500, with 77 per cent neutrophils. The icteric index was 30 units. The patient was placed on a low-fat, high-vitamin diet but continued to go downhill. About once every week he had a shaking chill lasting two or three hours. The urine became dark. Four months before entry a laparotomy at the other hospital revealed a large liver. Multiple punctures with a long needle failed to reveal an abscess. The common duct was palpated, but no stones were found. Postoperatively, the jaundice decreased slightly, but the anorexia and weekly chills continued. Frequent episodes of nausea and vomiting also began. A month before entry the abdomen began to swell.

The patient had had malaria when a youth. He drank alcoholic beverages about once a week, but never to excess.

Physical examination revealed a markedly jaundiced man, with evidence of recent weight loss. There were soft axillary lymph nodes, measuring up to 1 cm. in diameter. A few crackling inspiratory rales were heard at the right base. The heart was not enlarged. The abdomen was distended, with a definite fluid wave. The liver was moderately tender, and its edge was felt two fingerbreadths below the costal margin. The prostate was smooth and of twice the normal size. The right knee was ankylosed in full extension.

The temperature was 99.4°F., the pulse 100, and the respirations 26. The blood pressure was 130 systolic, 64 diastolic.

Examination of the blood revealed a red-cell count of 3,500,000, with a hemoglobin of 9.0 gm., and a white-cell count of 10,600, with 81 per cent neutrophils. The serum phosphorus was 3.5 mg., the nonprotein nitrogen 30 mg. and the total protein 6.9 gm. per 100 cc., with an albumin-globulin ratio of 0.6; the alkaline phosphatase was 27.5 Bodansky units per 100 cc. The van den Bergh reaction was 4.3 mg. per 100 cc. direct and 5.7 mg. total. The prothrombin time was 23 seconds (normal, 19 seconds). The urine gave a ++ test for albumin and a ++++ test for bile. The stools were formed, tan and guaiac negative.

X-ray films of the chest revealed a slightly elevated diaphragm on the right. A plain film of the abdomen showed slightly dilated loops of small bowel with homogeneous, ground-glass density.

A skin test with echinococcal antigen was negative.

The patient received several blood transfusions, a high intake of glucose orally as well as intravenously and 24,000 units of penicillin every three hours. At first there was a striking fall in temperature, but on the sixth hospital day, the temperature resumed a spiking course, frequently going above 102°F. On the seventeenth hospital day a paracentesis was performed, and 3300 cc. of yellow fluid with a specific gravity of 1.008 was withdrawn.

Another gastrointestinal series showed rather extensive curling of the lower esophagus but no definite evidence of varices. The duodenum and upper small intestine were within normal limits, but the patient was examined only in the horizontal position.

On the nineteenth hospital day an operation was performed.

DIFFERENTIAL DIAGNOSIS

DR. ARTHUR W. ALLEN: Dr. Schatzki, do you suppose that the x-ray films will help me?

DR. RICHARD SCHATZKI: I am afraid they will not be of much help. The plain film of the abdomen at the time of admission shows slight dilatation of the small bowel and increased density of the whole abdomen, as one would expect with fluid in the abdomen. On the chest film in the lateral view, there is, in addition to what is stated in the report, slightly more lobulation than is seen in the average patient. Lobulation of the diaphragm does not necessarily mean anything so far as disease is concerned, but in a patient with liver disease I should make a mental note of it but should usually not record it. Perhaps I am leading you astray. I do not know the answer.

DR. ALLEN: Neither do I.

DR. SCHATZKI: These films show a small hiatus hernia and a slightly tortuous esophagus, as one would expect with a high diaphragm. There is some curling of the esophagus, and the folds look thicker than they should be, even considering the high position of the diaphragm. In a patient with a tortuous esophagus, the differentiation of folds and varices is rather difficult and sometimes impossible to make, unless the varices are definite. They are certainly not definite in these films.

DR. ALLEN: We have a clear-cut story that ought to be correct so far as the findings at operation are concerned, in spite of the fact that this man was probably born in Greece, where echinococcal disease is frequent. He was undoubtedly studied with that point in view, and it is possible that the second exploration in the other hospital was performed to demonstrate an echinococcal cyst.

A disturbing feature about the history from the standpoint of diagnosis is the finding in the peritoneal cavity of a large amount of yellow-stained fluid with a low specific gravity. One must assume that this fluid was not bile but was possibly slightly bile stained, as all the tissue fluids were, and that it did represent a true ascites. That is unusual in the type of situation that I believe existed in this case. Free fluid is often found in patients who are chronically ill, particularly if they are ill with a disease that affects the liver. The negative x-ray examination for esophageal varices and the fact that there was no blood in the stools are evidence that this was not a simple cirrhosis of the liver of an independent nature. Of course, this patient had cirrhosis, which was probably a biliary cirrhosis on the basis of obstruction in the bile duct. I cannot see any connection between the early history of malaria and the condition as it is presented in the record.

The history goes back eighteen years, with a short episode of abdominal distress and swelling, lasting six days, that could have been the initial onset of difficulty with gallstones. There was another episode of nausea eleven years before entry, and an attack of sharp epigastric pain, which is compatible with real biliary colic, seven years later. The difficulty starting two years before entry, following the tooth extraction, represented the acute phase of the process — the tooth extraction, in my opinion, had nothing to do with the weight loss and the chills and fever, which indicate a cholangitis on the basis of infection, primarily originating in the gall bladder itself and finally involving the bile ducts. It would be extremely difficult to visualize this picture on the basis of any nonsurgical disease. The only point that bothers me is the ascites. The chance that this illness was caused by a tumor in the region of the head of the pancreas or the papilla of Vater is not great, although such a tumor, of course, would account for the ascites better than the situation that I believe existed.

The fact that the stools were tan interests me a little. No chemical test for bile is recorded. A deeply jaundiced person could have a stool that might be called tan because all the fluids in the body are naturally bile stained, but I believe that we must accept the fact that some bile was getting into the gastrointestinal tract, although not much, as in many patients with cholangitis with complete or almost complete obstruction. A small amount of bile seeps through an opening so small that on the operating table one cannot actually visualize it and wonders how any bile can get through at all.

At the first operation, when the gall bladder was removed, stones were found in a chronically thickened gall bladder. The important feature to me is that drainage through the wound continued for five months after the cholecystectomy. We are not told the nature of the fluid drained, but we must assume that it was bile. As this drainage to the outside began to decrease, the patient became jaundiced and began to have chills once a week. So long as bile was draining to the outside these chills probably did not take place, and he might have been in a fairly reasonable state of health, although the anorexia and weight loss were probably not corrected because we have no information that the lost bile was returned in any way to the gastrointestinal tract.

The causes of jaundice with cholangitis following cholecystectomy may be two: the first is an overlooked obstruction in the common bile duct, which may allow a certain amount of bile to get into the intestinal tract and which may occur with no evidence of jaundice. When there are a number of stones, bile seeps around them as water does in a stone drain in a wet field, and jaundice does not occur. A single stone or stones headed by a large stone in the ampulla are likely to cause complete jaundice and to allow less bile to seep through.

Cases of tumor in the region of the head of the pancreas often have intermittent phases of jaundice, and a certain amount of bile frequently gets into the gastrointestinal tract in spite of obstruction. The other cause (and I am sure that I was assigned this case because it was hoped that I should arrive at this conclusion, which is probably wrong) is that at the time of the cholecystectomy an injury to the common duct occurred. Unfortunately, this takes place often enough so that in a clinic such as this there are usually one or two such patients who have been sent in to have something done about the situation. This patient must have had an obstruction of some sort or an injury to the duct for bile to drain for five months after cholecystectomy. The gradual onset of the final condition following the original operation makes one wonder whether a tenting of the common bile duct, with a ligature around it, finally produced complete or nearly complete obstruction of the duct. The type of injury that usually precipitates early recognition is one in which the common bile duct is mistaken for the cystic duct and a large portion of it is removed.

I therefore conclude that this man had an injury to the common bile duct, and that he had, of course, biliary cirrhosis due to the obstruction and cholangitis in addition to or as a result of the injured duct.

Dr. Tracy B. Mallory: Will you tell us the opinion on the wards, Dr. Volwiler?

Dr. Wade Volwiler: There were three things we argued about considerably on the medical service before exploration. The most troublesome was the problem of ascites, which also bothered Dr. Allen. It was certainly a transudate. We did not believe that a biliary cirrhosis was necessarily present. The albumin-globulin ratio, although considerably reversed, was not lower than that in prolonged obstructive jaundice and malnutrition without biliary cirrhosis. We have seen several cases in the last few years in which an inflammatory process in the region of the gall bladder or a pylephlebitis has occurred with massive ascites. Dr. Linton's theory was that a partial lymphatic block allowed localization of fluid in that area. We have seen several patients with complete biliary obstruction, with clay-colored stools of four to six months' duration, who at operation or at post-mortem examination showed no histologic signs of biliary cirrhosis. I think that there is no way of predicting whether or not such cirrhosis will be found, unless there are secondary xanthomas. I am sure that the element of infection is important in its production, and I suppose that in this case it would be a safe bet.

We were also uncertain whether or not there were hepatic abscesses, with the high temperature and the chills and fever. The liver was definitely tender to palpation, which we thought was another point in favor of abscess, although the white-cell count was always much lower than that in most cases.

Dr. Mallory: Did you assume that the liver was large?

Dr. Volwiler: We thought it was somewhat larger than normal, but we see enlarged livers merely from bile stasis, without any additional intrahepatic fibrosis.

Dr. Allen: I might add that I have seen a number of these patients with injuries to the bile duct who finally came in with a tender liver; not all are tender, but some definitely are.

Clinical Diagnosis

Common-duct stone.

Dr. Allen's Diagnoses

Common-duct injury.
Biliary cirrhosis.
Cholangitis.

Anatomical Diagnoses

Defect of common bile duct, postoperative.
Cholangitis.
Biliary cirrhosis.
Erosion of intrahepatic branch of portal vein, with hemorrhage.
Intrahepatic cholelithiasis.
Bronchopneumonia.
Recent operative wounds; choledochojejunostomy, jejunojejunostomy.

Pathological Discussion

Dr. Mallory: At operation only insignificant remnants of the common bile duct could be found. It was necessary to do an anastomosis of a loop of jejunum to the right hepatic duct practically within the hilus of the liver. This was carried out successfully, although with considerable difficulty, and a series of adjusting anastomoses were made in the small intestine. A drain to the exterior was also placed in the hepatic duct. Following operation the patient did well for about two weeks and then began to have a series of massive hemorrhages through the drainage tube in the abdominal wall and also in the bowel. He passed several tarry stools. On two occasions he bled himself out almost completely, passing at one time into a stage of unconsciousness. He was revived with multiple transfusions. Two days after one of these episodes he was up in a wheel chair again and, for the moment, in excellent condition. He had a final massive hemorrhage, however, and died.

At autopsy we found that a large segment of common bile duct was missing. Only 2 or 3 cm. of the duct remained next to the duodenum, and a large stone, nearly 2 cm. in diameter, was found impacted in the ampulla. Above the point where the duct had

been transected additional stones were found in branches of the hepatic duct throughout the left lobe of the liver. The intrapehatic bile ducts were markedly dilated in both lobes; there were multiple stones in the ducts of the left lobe, but none in the ducts of the right lobe. There was an extremely severe biliary cirrhosis — one of the most marked that I have ever seen. There was also a marked cholangitis extending throughout all the radicles of the biliary system. It was an inflammatory process extending from the infected bile ducts that had eroded into a branch of the portal vein within the liver and had produced the fatal hemorrhage. One of the surprising facts at autopsy was that, in spite of the long-continued obstructing jaundice and the multiple episodes of hemorrhage into the ducts, the kidneys were almost perfectly normal. There was terminally a rather extensive bronchopneumonia.

DR. ALLEN: Was there any evidence that the erosion between the hepatic duct and the branch of the portal vein had been produced by the tube used at the anastomosis?

DR. MALLORY: As I read the record, I do not believe so.

DR. ALLEN: I do not believe that we have ever seen such erosion in all the cases in which we have repaired the bile duct.

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CONTROL OF TYPHOID FEVER AND TUBERCULOSIS

THE effectiveness of the application of sound public-health principles is no better illustrated than by the decrease in deaths from typhoid fever that has occurred in the large cities of the United States during the last thirty-six years. In 1945, according to the most recent report,[1] there were only 80 deaths in seventy-eight cities with a total population of 35,895,638, whereas in 1910 there were 4637 deaths in the same cities, whose total population at that time was 22,573,435. The respective death rates per 100,000 are 0.22 and 20.51, a difference of nearly a hundredfold. In 1945, fifty-six cities reported no deaths, thirty-one had death rates varying between 0.1 and 0.9, five between 1.0 and 1.9, and one between 2.0 and 4.9; whereas in 1910, of the seventy-seven cities whose statistics are available, two had rates ranging from 5.0 to 9.9, and in the remainder the rates were 10.0 and over. In the period 1941-1945, the rates according to geographical divisions are as follows: 0.14, New England; 0.16, East North Central and West North Central; 0.17, Middle Atlantic; 0.23, Mountain and Pacific; 0.54, South Atlantic; 0.57, East South Central; and 0.89, West South Central.

Owing to proper control of water supplies and sewage disposal and to regulations governing the distribution of milk and other foodstuffs, including the handling of food, epidemics of typhoid fever are essentially things of the past. The cases that do occur, particularly those in areas with low mortality rates, are usually due to direct or indirect contact with an unrecognized typhoid carrier. In Massachusetts, for example, there are approximately 175 recognized typhoid carriers at the present time, and it is estimated that there are probably in the neighborhood of 1000 unrecognized carriers. Although it is possible to minimize the risk of contagion from those who are known to excrete typhoid bacilli from the gastrointestinal or urinary tract, obviously nothing can be done to control the spread of infection by the unrecognized carrier. Over the course of years, however, the number of such persons is certain to approach zero. In spite of the fact that the subcutaneous injection of typhoid vaccine results in a reasonably effective immunity against typhoid infection, there appears to be no indication for its use, unless a person resides in or plans to visit an area in which the disease is endemic or temporarily epidemic.

This present mode of infection in typhoid fever parallels that for tuberculosis, in that both are largely contracted from persons with unrecognized infections. Now that tuberculosis has been practically eliminated from dairy herds and the milk from the occasional tuberculous cow is rendered innocuous by pasteurization, the spread of this disease depends chiefly on contact with human tubercle bacilli from persons having recognized or unrecognized open tuberculous lesions.

Fifty years ago, when infection with tuberculosis was almost universal, little could be accomplished in limiting the foci of infection. With a drop of some

85 per cent in the death rate, however, the picture has radically changed and, as in typhoid fever, the infectious case has become the primary object of attack. In tuberculosis only the open case is a source of infection, and the continued, steady decline of the disease in this country during the last seventy-five years is convincing evidence that, on the whole, each case is giving rise to less than one new case. As Frost[2] has well pointed out, this can only mean that the biologic balance is against the survival of the tubercle bacillus and, if this balance can be maintained, that the ultimate eradication of tuberculosis is a possibility.

As the incidence of tuberculosis decreases, concentration on the open case will yield increasing returns. This means early diagnosis and prompt hospitalization of active cases and routine x-ray examination of all family contacts, especially adults. Since experience has shown, however, that, even under the most favorable conditions, not over half the new cases can be traced to direct contact, the net must be spread wide to be really effective. This has become practical with the development of photofluorography during the past few years. Under the Selective Service system nearly 20,000,000 young men and women in this country were screened with x-ray films of the chest and approximately 1.25 per cent were rejected because of the findings. On the basis of discharge examinations it is estimated that the incidence of tuberculosis in the armed forces of the United States in World War II was only about one tenth of that in World War I. At the same time some 2,000,000 workers in arsenals, shipyards and war industries received routine x-ray examination, largely through the efforts of the United States Public Health Service.

Facilities for routine x-ray examination of household contacts of tuberculous patients are now available to physicians in nearly all states. Many state health departments, often with the assistance of voluntary associations, have embarked on programs for the routine examination of industrial workers. Some have already begun mass x-ray examination of the adult population of entire communities for the discovery of unrecognized foci of infection. Hospitals offer a fertile field for this type of case finding, both for the detection of unsuspected cases among patients and for the protection of nurses and other employees.

The problem of control in tuberculosis is more complex than that of typhoid fever, but the principles are becoming more and more similar. In tuberculosis, individual resistance plays an important but still largely unmeasured role and the influence of environment was again tragically demonstrated in invaded countries in the recent war. When, in addition to routine examination of suspects and household contacts, mass x-ray screening of the adult population is provided, as well as adequate sanatorium facilities for the isolation and treatment of all active cases, and when nations have learned how to live for more than one generation without war, tuberculosis should become as truly preventable as typhoid fever.

References

1. Special Article. Typhoid in large cities of United States in 1945: thirty-second report. *J. A. M. A.* **131**:817-821, 1946.
2. Frost, W. H. Outlook for eradication of tuberculosis. *Am. Rev. Tuberc.* **32**:644-650, 1935.

FULTON'S *HARVEY CUSHING*

Medicine in general has been unusually fortunate in the biographers of her worthies. *The Life of Sir William Osler*, by Harvey Cushing, a full two-volume estimate of Osler and his influence on Canadian, American and English medicine, published in 1925, set a standard never before reached in medical biography in this country and indeed seldom equaled in all the history of physic. One can only compare it with Stephen Paget's discriminating study of Victor Horsley or with Humphry Rolleston's thoughtful biography of Clifford Allbutt, to mention only two outstanding modern examples. As the Cushing volume is so richly autobiographical, there comes to mind also those more personal reminiscences of contemporary physicians, such as Hans Zinsser's appealing *As I Remember Him: The biography of R. S.*, Ramón y Cajal's penetrating *Recollections of My Life*, Bland-Sutton's sprightly *The Story of a Surgeon*, August Forel's *Out of My Life and Work* and, in a lighter vein, *The Horse and Buggy Doctor* by Hertzler and *Sands of Time* by Purves-Stewart. To these of recent date should be added the fine tribute to Théodore Tronchin by Henry Tronchin and the memorable account of

William Henry Welch by Simon Flexner and his gifted son James Thomas Flexner.

To this brief list, fully recognized as incomplete, must now be added the biography of Harvey Cushing by John F. Fulton. Few biographies are more satisfying than this competent life. Much was told by Cushing himself, and a mosaic, based on such original sources, has been judiciously fitted into a full portrait by his skilful biographer.

A review of the book appears elsewhere in this issue of the *Journal*. The volume is a worthy contribution to medical biography, and physicians, medical students and indeed the lay public should find inspiration and a stimulus to greater things in reading the life of the outstanding surgeon of his age and a medical pioneer of no mean ability.

MASSACHUSETTS MEDICAL SOCIETY

DEATHS

PAINTER — Charles F. Painter, M.D., of Brookline, died January 6. He was in his seventy-eighth year.

Dr. Painter received his degree from Harvard Medical School in 1895. He was formerly dean of Tufts College Medical School, librarian of the Boston Medical Library, for many years a member of the editorial board of the *Journal of Bone and Joint Surgery* and editor of the *Yearbook of Orthopedic Surgery*. He was a fellow of the American College of Surgeons, an emeritus member and former president of the American Orthopaedic Association and an emeritus member of the American Academy of Orthopaedic Surgeons.

His widow, a son and a daughter survive.

STONE — George H. Stone, M.D., formerly of Worcester, died January 4. He was in his sixty-sixth year.

Dr. Stone received his degree from Bowdoin Medical School in 1908. He was formerly superintendent of Worcester Memorial Hospital and was a fellow of the American Medical Association.

NEW HAMPSHIRE MEDICAL SOCIETY

ROCKINGHAM COUNTY *NEWS*

A leaflet *Rockingham County Medical Society News* is now being sent out monthly from the office of the secretary, Dr. Donald W. Leonard, of Exeter. The December, 1946, copy contains a short report of the annual meeting, an account of a meeting of the Women's Auxiliary, information from the secretary of the New Hampshire Medical Society, a list of the officers of the county society and a note regarding the annual meeting of the New Hampshire Medical Society.

By this means, the officers of the Rockingham County Medical Society plan to keep its members informed concerning news within the county and to carry announcements, with the hope that this will stimulate greater interest in the affairs of the society, particularly its regular meetings.

NOTE

The following New Hampshire physicians were recently appointed fellows in the American College of Surgeons: William P. Clough, Jr., New London; Edward D. Hagerty, Nashua; B. Read Lewin, Claremont; and Raymond R. Perreault, Rochester.

BOOK REVIEW

Harvey Cushing: A biography. By John F. Fulton, M.D. 754 pp. Springfield, Illinois: Charles C Thomas, 1946. $5.00.

Harvey Cushing, neurosurgeon, author, diarist, bibliophile and scholar, whose name ranks with those of William Osler, William H. Welch and others, stands out as one of the great physicians of our time. He was quite possibly the most distinguished graduate of the Harvard Medical School, certainly one of the greatest of American surgeons and, without question, a man whose influences in more than one field of medicine will have enduring recognition. To have virtually developed a new department of surgery, to have written the foremost biography of a contemporary medical figure, — a book widely proclaimed both in and out of his profession, — and to have greatly enriched the fields of medical history and science are accomplishments of no mean order. Harvey Cushing did each of these and, in addition, molded the lives of countless young men who later, in turn, have made no inconsiderable advancements in the progress of medicine. Not the least of those he trained is his talented pupil and friend of his later years, a distinguished professor of physiology and the author of his biography. Harvey Cushing, long anticipating that an account of his eventful life might be of use to future students of medicine, kept voluminous notes and diaries, almost writing his own biography by the daily activity of his pen. Few men have left a larger accumulation of pertinent material for a competent biographer to sift, or more remarkable papers and drawings on which the latter could base the reactions of his subject to the events of his time.

Harvey Cushing was born in Cleveland, Ohio, on April 8, 1869, the descendant of an English family that came to New England in 1638. His grandfather, Erastus Cushing, M.D., the son of a country doctor, emigrated by the Erie Canal to the Western Reserve of Connecticut in 1835, and there, in Cleveland, his father, Henry Kirke Cushing, M.D., was brought up. The latter was a shy, somewhat austere and puritanical person, although highly regarded as a practitioner of gynecology and obstetrics. With the heavy responsibilities of a large family, Dr. Cushing was frugal to the point of penuriousness. Often silent and secretive for days, speaking to no one in his family, he led at times a somewhat somber life. Harvey Cushing's mother, on the other hand, was even-tempered, forceful and kindly, with humor, grace and an inner gaiety of spirit. Some of these qualities, as well as some from his father, Harvey Cushing inherited in full measure. He was the youngest in a family of ten children; only seven lived to maturity. One brother also became a physician, and the others were supplied by their thrifty father with splendid educations. The eldest graduated from the Harvard Law School and practiced his profession in Cleveland for many years; another graduated from Cornell University and became a geologist of note; the older brother who became a physician went to Cornell and then to the Harvard Medical School; and Harvey was sent to Yale and then to the Harvard Medical School. Surely few fathers have given their sons better educational opportunities than did the penurious Cleveland practitioner.

Harvey Cushing's career at Yale was that of an undistinguished but creditable scholar, a superb athlete, particularly brilliant in baseball and adept at gymnastics, and a popular boy who was elected to the proper clubs in spite of his father's disapproval of both intercollegiate athletics and college societies. Cushing's ability to make sketches and his powers of description were already discernible in his college years. Preserved are the diagrams of his first quarters in New Haven and a striking description, in a letter to his mother, of the blizzard of 1888.

Turning to medicine, Cushing entered the Harvard Medical School in 1891. The high stone steps of the building (now part of Boston University) on Boylston Street in Boston tempted him to repeat his performance off the steps of the Yale gymnasium, and with a lighted cigarette in his mouth he turned a back somersault, landing upright on the bare sidewalk with the cigarette still going. This no doubt made the transition from New Haven to Boston less difficult than he had expected, but Cushing soon developed an uneasiness about Harvard that he never quite overcame. He soon became heavily involved in his studies, however, and by the second half of his second year he was etherizing for Dr. Warren. One

of his first patients died under the anesthetic, a profound shock to the sensitive young medical student. Later, he became depressed, with frustrations and a feeling of inadequacy, but these he overcame by dint of hard work, which won for him a surgical internship at the Massachusetts General Hospital. He was regarded by his friends as the ablest man in his class. While a student he, with Amory Codman, devised a chart for recording the temperature and pulse of a patient during etherization. When serving as an intern, he and Codman again collaborated, this time on x-ray photographs. In the spring of 1896 they purchased a crude machine and took some pictures, activating their x-ray tube by a hand-driven static machine and using exposures up to twenty minutes to get a clear plate. Cushing, even in those days, was a perfectionist, difficult to work with and ambitious almost to a point of intolerance, arousing many animosities among his fellow workers. He was also critical of his surgical teachers, writing that "these men operate about the way a commercial traveler grabs breakfast at a lunch counter."

In 1896 Cushing went to the Johns Hopkins Hospital to serve as an assistant resident in surgery under Dr. William S. Halsted. There he remained for thirteen years. Bringing down his x-ray apparatus from Boston, in 1896 Cushing made the first x-ray films taken at Hopkins. A patient with a bullet in the cervical spinal cord interested him and, using photographs of x-ray films as illustrations, he published his first formal piece of writing in 1897. Cushing soon became a great favorite with the patients in the wards — but not always with the nurses or his fellow members of the staff. Dr. Halsted was often sick, and Cushing saw little of him during his three years as resident. He thus had more responsibility than most house surgeons and more opportunity for developing his own technics. Following Halsted's work on cocaine infiltration, Cushing began a series of studies on block anesthesia in 1898. Then came a pioneer development in the handling of patients with typhoid perforations and a paper on gonococcal peritonitis.

Going abroad in 1900, Cushing went to Berne, where he did experimental work in Kronecker's laboratory and attended Theodor Kocher's clinic. He carried his experiences with animals in Kocher's laboratory, where he observed the brain through a small window in the skull, to Mosso in Turin. There, using the same technic, he studied a man with a cranial defect. Seeing a model of Riva-Rocci's blood-pressure device in Pavia, Cushing promptly sketched it and brought a model back to Baltimore when he returned home. Most of his investigations at various centers were followed by papers, published in current journals. In some instances these had a bluntness and lack of diplomacy that caused considerable disconcertion among his senior men, who were accustomed to write papers in their own names that were based on the work of their pupils. Later came a productive month with Sherrington in Liverpool before returning to America.

Returning to Johns Hopkins Hospital in 1901, at the age of thirty-two, Cushing began practice, living next door to the Oslers, at 3 West Franklin Street. With Thomas B. Futcher and Henry Barton Jacobs, he became one of the "latchkeyers" to the "man-next-door," William Osler, whose life he described many years later in the most successful medical biography of its time. He then developed a growing interest in surgery of the nervous system, spaced with experimental studies on blood pressure, courses in graduate instruction in general surgery and studies in the physiology of saline solution.

Cushing had long shown more than a casual interest in neurologic surgery, first at the Massachusetts General Hospital and later in his experimental researches abroad. At Hopkins his attention was directed to this special field of therapy through a simple operation for meralgia paresthetica on the astrophysicist Simon Newcomb, a long series of investigations on the Gasserian ganglion and a special assignment to this department of surgery under Dr. Halsted. By 1904 he was ready to make his first report as a "brain surgeon," and in 1908 he wrote the long chapter "Surgery of the Head" for Keen's *Surgery*. The operative mortality was so high in those days that Cushing at once turned to the problem of improvement in technic, devising the cranial tourniquet and new instruments. Also, he began his study of the pathology of brain tumors, noting their variation in recurrence and other features of their natural history.

From 1908 to 1912 came the period of the experimental work on the pituitary body, the development of suboccipital exposure for cerebellar tumors, trips to Europe, the first operation on General Leonard Wood in 1910 and the publication of the pituitary monograph in 1912. Cushing had a curious way of setting up a theory and then making every effort to prove it, even when accumulated evidence showed that his theory was based on unsound premises. He was led astray regarding the finding of pituitary extract in the spinal fluid and never admitted that he was wrong, a curious foible in a man who had so many obvious virtues as an investigator. This caused some of his junior associates to waste valuable time in attempting to establish Cushing's original contention. The pituitary monograph, however, was characterized by the remarkable case histories, the discussion on acromegaly, gigantism and hypopituitarism, the microscopic studies and the development of the surgical approach to pituitary tumors, all contributions of major importance. As Osler remarked, it opened "several new chapters in cerebral physiology, to say nothing of metabolism."

In 1912 Cushing removed to the newly established Peter Bent Brigham Hospital in Boston as surgeon-in-chief and at the same time became the Moseley Professor of Surgery at Harvard University. Here he continued and greatly expanded his brain-tumor clinic, developed a new series of research problems, trained a long list of young students, interns and residents and made Boston a center for neurosurgery. His special field of endeavor was twice interrupted by war — first in 1915 when he led the Harvard Surgical Unit to Paris and secondly by his command of Base Hospital No. 5, which went overseas in 1917. His voluminous diaries were partly published in the book "From a Surgeon's Journal" in 1936. Back in Boston, his clinic ever expanding and the Society of Neurological Surgeons founded, Cushing turned to preparation of the Osler biography, his major literary work and possibly his greatest contribution to fame. The book, published in 1925, received wide acclaim and was awarded the Pulitzer Prize in 1926. Five more years brought his operations on brain tumor cases to over two thousand, and with the description of a new syndrome, pituitary basophilism, his active work in surgery drew to a close. His last operation occurred in August, 1932, at the age of sixty-three. Leaving Boston he settled happily in New Haven, near his old and cherished Yale University, where he remained, developing a brain-tumor registry, exploring his library and making plans to leave it to the University, writing his biobibliography of Vesalius and, except for periods of great pain and distress, enjoying life to the utmost with old and new friends until his death in 1939.

His biographer has wisely kept a restraining hand on the more turbulent moments, and with studied care he has etched a portrait of Cushing without giving offense. Harvey Cushing was too great a man for some of his nimble jumps into controversy not to be overlooked, as he did so frequently himself. But, as with his famous backward somersault, he usually came up aright, with cigarette glowing and much justified applause for his audacity. In the intenseness of his life much was sometimes ruthlessly pushed aside, but he not infrequently showed the warmer side of his nature with equal or even greater fervor. So many acts of kindness went untold — medical students helped both financially and spiritually, friends made unexpectedly happy by unannounced visits, gifts on appropriate occasions and messages to those in distress. Few men have had a "harder" practice, for patients with brain tumors bring many problems to the neurosurgeon, often of a tragic nature. Cushing felt deeply and was profoundly touched by misfortune, as many a patient and friend can testify. His brusqueness, too, hid an essentially shy, sensitive nature, for at heart he was a deeply lovable person, driving himself and being driven by the environment he created to heights not often attained. He flew high and straight, maintaining an altitude of greatness throughout his life. In reading his skillfully written biography one never glimpses Cushing as "grounded."

The book is published in a fitting manner, finely printed and illustrated. Only two devoted friends, his biographer and the publisher, could combine to make a volume so representative of the man who meant so much to both of them. Modestly priced to fit the pocket of the medical student of the day, the book should be compulsory reading for every man and woman entering medicine as a profession. Poor indeed is the student who cannot gain from reading the life of one of America's finest products, a man who inspired his contemporaries as few others have done and who will continue to enrich the lives of those that come after him, thanks to this worthy volume.

BOOKS RECEIVED

The receipt of the following books is acknowledged, and this listing must be regarded as a sufficient return for the courtesy of the sender. Books that appear to be of particular interest will be reviewed as space permits. Additional information in regard to all listed books will be gladly furnished on request.

The Clinical Application of the Rorschach Test. By Ruth Bochner, M.A., psychologist, Bellevue Psychiatric Hospital, New York City; and Florence Halpern, M.A., psychologist, Bellevue Psychiatric Hospital. Second edition, revised and enlarged. 8°, cloth, 331 pp. New York: Grune and Stratton, 1945. $4.00.

The first edition of this book was well received when published a few years ago. Since that time the authors have added a considerable amount of material on this subject, one of the most frequently used tests in studying the field of personality. The authors believe that this test contributes materially to the subject in a manner that cannot be obtained through the medium of other technics. The test, however, as they point out, has distinct limits. The book has become a standard text in its field.

Active Psychotherapy. By Alexander Herzberg, M.D., Ph.D. 8°, cloth, 152 pp. New York: Grune and Stratton, 1945. $3.50.

The author has a wide experience in the treatment of psychoneuroses, both in Germany and in England, and this book reflects his experience. Many case histories are given in some detail, along with facts on the technic of psychoanalysis and its value to psychiatry. The book is concise and practical, for it is based on the study of 500 cases over a period of twenty years.

The Osseous System: A handbook of roentgen diagnosis. By Vincent W. Archer, M.D., professor of roentgenology, University of Virginia Department of Medicine. 8°, cloth, 320 pp., with 148 plates. Chicago: The Year Book Publishers, Incorporated. $5.50.

This book has been written for the occasional radiographer and should therefore be considered a primer rather than a comprehensive text. In writing the work the author has taken advantage of mistakes that have been observed over a period of twenty years in a teaching position and in hospitals, as well as those made by individual physicians.

Skin Diseases in Children. By George M. MacKee, M.D., professor of clinical dermatology and syphilology, New York Post-Graduate Medical School, Columbia University; and Anthony C. Cipollaro, M.D., associate in dermatology and syphilology, New York Post-Graduate Medical School, Columbia University. 8°, cloth, 448 pp., with 225 illustrations. New York: Paul B. Hoeber, Incorporated, 1946. $7.50.

This book has been written chiefly for the general practitioner, and the second edition has been thoroughly revised to date. Special attention is given to methods of treatment that are suitable for the use of the family physician. Many new photographs and colored plates have been added.

Gastro-Enterology. Volume III. *The Liver, Biliary Tract and Pancreas, and Secondary Gastro-Intestinal Disorders.* By Henry L. Bockus, M.D., professor of gastroenterology, University of Pennsylvania Graduate School of Medicine; and colleagues. 8°, cloth, 1091 pp., with 427 illustrations. Philadelphia and London: W. B. Saunders Company, 1946. $11.00.

This last volume of a standard reference system is the joint work of fourteen members of the faculty of the Graduate School of Medicine of the University of Pennsylvania. To each chapter is appended a selective bibliography. The book is well printed on coated paper, which makes it rather heavy for its size. The complete set of three volumes should be in the reference collections of all medical libraries.

Transactions of the American Association of Genito-Urinary Surgeons: Fifty-sixth annual meeting held at Stockbridge, Massachusetts, June 8, 9 and 10, 1944. Volume XXXVII. 8°, paper, 315 pp., with illustrations. Saint Paul and Minneapolis: The Bruce Publishing Company, 1945.

NOTICES

BOSTON MEDICAL HISTORY CLUB

There will be a meeting of the Boston Medical History Club in Sprague Hall at the Boston Medical Library, 8 Fenway, on Monday, January 27, at 8:15 p.m. Dr. Merrill Moore will speak on the subject "Medical Experiences in New Zealand and China."

All interested persons are cordially invited to attend this meeting.

GREATER BOSTON MEDICAL SOCIETY

A meeting of the Greater Boston Medical Society will be held in the auditorium of the Beth Israel Hospital on Tuesday, February 4, at 8:15 p.m. Dr. Ephraim Shorr, associate professor of medicine, Cornell University Medical College, will speak on the subject "Metabolic Aspects of Renal-Stone Formation and Prevention."

TUFTS ALPHA OMEGA ALPHA

The Tufts chapter of the Alpha Omega Alpha will meet in the auditorium of the Beth Israel Hospital, Boston, on Wednesday, February 26, at 8:30 p.m. Dr. Harry Gold, of the Department of Pharmacology, Cornell University Medical College, will speak on the subject "Cardiac Therapy."

MASSACHUSETTS MEDICO-LEGAL SOCIETY

The midwinter meeting of the Massachusetts Medico-Legal Society will be held at the Magrath Library, Department of Legal Medicine, Harvard Medical School, on Wednesday, February 12, at 2:30 p.m.

PROGRAM

Short Reports of Cases:

- Two Cases of Fatal Air Embolism. Drs. Andrew D. Guthrie and Walter W. Jetter.
- Rapidly Fatal Unrecognized Intestinal Obstruction due to Adherent Meckel's Diverticulum. Drs. Andrew J. Leddy and Richard Ford.
- An Unusual Case of Pentobarbital Poisoning. Drs. George D. Dalton and Russell S. Fisher.
- Pseudo-Appendicitis incident to Fatal Reaction to Rabies Vaccine. Drs. Peirce H. Leavitt and Angelo Lapi.

Discussion of Problems of Procedure:

- Circumstances in Which the Filing of an Incomplete "Under Investigation" Death Certificate May Be Desirable. Dr. Timothy Leary.
- Reimbursement of Undertakers for Transportation of Bodies and Use of Mortuary Facilities. Dr. Leroy T. Stokes.
- When and How Should a Medical Examiner Report a Death for Inquest (Section 8, Chapter 38, General Laws)? Dr. David C. Dow.

Business Meeting

Refreshments

CORNELL MEDICAL ALUMNI DAY

Alumni Day for Cornell University Medical College will be held on March 13. It will include registration in the morning, with luncheon at the Nurses Residence, to be followed by the business meeting and a schedule of rounds and conferences in all departments. Dinner will be served at the Hotel Roosevelt, and dancing will conclude the day.

(*Notices continued on page xix*)

NOTICES (*Continued from page 156*)

SOCIETY MEETINGS AND CONFERENCES

CALENDAR OF BOSTON DISTRICT FOR THE WEEK BEGINNING THURSDAY, JANUARY 30

FRIDAY, JANUARY 31

*9:00–10:00 a.m. Approach to the Diagnosis and Treatment of Gout. Dr. Elmer C. Bartels. Joseph H. Pratt Diagnostic Hospital.

*10:00 a.m.–12:00 m. Medical Staff Rounds. Peter Bent Brigham Hospital.

MONDAY, FEBRUARY 3

*12:15–1:15 p.m. Clinicopathological Conference. Peter Bent Brigham Hospital.

TUESDAY, FEBRUARY 4

12:00 m.–1:00 p.m. Dermatological Service, Grand Rounds. Amphitheater, Dowling Building, Boston City Hospital.

*12:15–1:15 p.m. Clinicoroentgenological Conference. Peter Bent Brigham Hospital.

8:15 p.m. Greater Boston Medical Society. Auditorium, Beth Israel Hospital.

WEDNESDAY, FEBRUARY 5

*11:00 a.m.–12:00 m. Medical Clinic. Amphitheater, Children's Hospital.

*12:00 m. Clinicopathological Conference. (Children's Hospital.) Amphitheater, Peter Bent Brigham Hospital.

*2:00–3:00 p.m. Combined Clinic by the Medical, Surgical and Orthopedic Services. Amphitheater, Children's Hospital.

*Open to the medical profession.

OCTOBER 11–MAY 14. Metropolitan State Hospital. Page 398, issue of September 12.

JANUARY 27. New England Heart Association. Page 120, issue of January 16.

JANUARY 27. Boston Medical History Club. Page 156.

FEBRUARY 4. Greater Boston Medical Society. Page 156.

FEBRUARY 7. American Board of Obstetrics and Gynecology. Page 44, issue of January 2.

FEBRUARY 9. National Conference on Medical Service. Page 956, issue of December 26.

FEBRUARY 11. Harvard Medical Society. Amphitheater, Peter Bent Brigham Hospital. 8:00 p.m.

FEBRUARY 12. Massachusetts Medico-Legal Society. Page 156.

FEBRUARY 13. The Clinical Importance of the Blood Type in Transfusions and in Obstetric Patients. Dr. Louis K. Diamond. Pentucket Association of Physicians. 8:30 p.m. Haverhill.

FEBRUARY 26. Tufts Alpha Omega Alpha. Page 156.

MARCH 13. Cornell Medical Alumni Day. Page 156.

APRIL 28–MAY 2. American College of Physicians. Page 206, issue of August 8.

MAY 20–22. Massachusetts Medical Society. Annual meeting. Hotel Statler, Boston.

JUNE 9–13. American Medical Association. Page 698, issue of November 7.

JUNE 30–JULY 3. American Urological Association. Hotel Statler, Buffalo.

SEPTEMBER 8–12. American Congress on Obstetrics and Gynecology. Page 636, issue of October 24.

DISTRICT MEDICAL SOCIETY

PLYMOUTH

FEBRUARY 20. Moore Hospital, Brockton.
MARCH 20. Goddard Hospital, Brockton.
APRIL 17. State Farm, Bridgewater.
MAY 15. Lakeville Sanatorium, Lakeville.

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Mason Drug Company

Boston 18, Massachusetts

It Can Happen Here

Example of severe rickets in a sunny clime.

LEST WE FORGET—we who are of the vitamin D era—severe rickets is not yet eradicated, and moderate and mild rickets are still prevalent. Here is a white child, supposedly well fed, if judged by weight alone, a farm child apparently living out of doors a good deal. This boy was reared in a state having a latitude between 37° and 42°, where the average amount of fall and winter sunshine is *equal to that in the major portion of the United States*. And yet such stigmata of rickets as *genu varum* and the quadratic head are plain evidence that rickets does occur under these conditions.

How much more likely, then, that rickets will develop among city-bred children who live under a smokepall for a large part of each year. True, vitamin D is more or less routinely prescribed nowadays for infants. But is the antiricketic routinely administered in the home? Does the child refuse it? Is it given in some unstandardized form, purchased from a false sense of economy because the physician did not specify the kind?

A uniformly potent source of vitamin D such as Oleum Percomorphum, administered regularly in proper dosage, can do more than protect against the gross visible deformities of rickets. It may prevent hidden but nonetheless serious malformations of the chest and the pelvis and will aid in promoting good dentition. Because the dosage is measured in *drops*, Oleum Percomorphum is well taken and well tolerated by infants and growing children.

EXIGENCY OF WAR

Oleum Percomorphum 50% is now known as Oleum Percomorphum with other Fish Liver Oils and Viosterol. The potency remains the same; namely, 60,000 vitamin A units and 8,500 vitamin D units per gram. It consists of the liver oils of percomorph fishes, viosterol, and fish liver oils, a source of vitamins A and D in which not more than 50% of the vitamin D content is furnished by viosterol.

Supplied in 10 c.c. and 50 c.c. bottles; and as capsules in bottles containing 50 and 250.

MEAD JOHNSON & COMPANY, EVANSVILLE, INDIANA, U.S.A.

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